

Math I-1

Activities

Place Value

Place Value and Rounding

Standard I:

Students will understand the base-ten numeration system, place value concepts, simple fractions and perform operations with whole numbers.

Objective 1:

Represent whole numbers up to 10,000, comprehend place value concepts, and identify relationships among whole numbers using base-ten models and symbolic notation.

Intended Learning Outcomes:

1. Develop a positive learning attitude toward mathematics
4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.
6. Represent mathematical ideas in a variety of ways.

Content Connections:

Math I-3; Estimation, place value with addition and subtraction

*Math
Standard
I*

*Objective
1*

Connections

Background Information

Students should have knowledge of place value of a given digit up to and including a five-digit numeral and have had a chance to practice and understand the concept of place value. They should have understanding of numbers and number sense. Students should be taught specific vocabulary relating to the lesson before you begin. This should include: numeral, digit, and place value. The first activities taught at the 2008 Core Academy on place value will give your students the background knowledge they will need to know before you teach the activities listed below.

Research Basis

Klein, K., & Jones, R., (2003). How Teachers Phrase Discussion Questions. Retrieved November 24, 2006, from Studies of Teaching 2003 Research Digest, Wake Forest University Leah P. McCoy, Editor

Classroom discussion is one of the most important teaching techniques used to help students learn and understand the information they are being taught. Discussion allows the students to become engaged with the material by formulating their own opinions, listening to other students' opinions, and applying specific information to a broader situation.

Mulvan, C. (1995). Involvement and participation in cooperative small groups in mathematics. *Elementary school journal*, Volume 95.4 p. 297.

Students do not fully understand math concepts if they cannot relate it to something in their own experiences. The use of many

different techniques help make mathematics a pleasure rather than a chore. Students are more active learners and are more motivated when they work in small groups.

Invitation to Learn

Materials

- ☐ Digit Cards
- ☐ Place Value Cards



This activity is called “Place Value Match-Up”. Have students draw five blanks in their journal to represent a five-digit number. You have the *Place Value Match-up Digit Cards* that include 0-9. You also have *Place Value Cards* that include 10,000s, 1,000s, 100s, and 10s. Shuffle the ten digit cards. Draw a card and announce the digit to the class. Each student writes that digit in one of his five blanks. After the digit is written it cannot be moved. Lay the card aside, and continue drawing and announcing four more cards. (Keep these cards together to use later). After you have drawn five cards, each student will have written a five digit number. Mix up the five discarded cards. Draw one place value match up digit card and one place value card. If a student’s number matches both the digit card and the place value card then he earns one point. If a student has a match he/she can draw a circle around their number. Continue drawing four more pairs of cards: one each of the discarded digit cards and one of the place value cards. If all five of a student’s digits match, he earns a bonus of five extra points for a total of ten points altogether.

Instructional Procedures

Materials

- ☐ Rounding Mountains
- ☐ Number Lines
- ☐ White Boards
- ☐ Overhead markers



Rounding

1. Each student should receive a *Rounding Mountains* sheet. Hand these out after you have taught them how to round using the rounding mountains.
2. The teacher should have an overhead made of the Rounding Mountains. Show the overhead to the students.
3. The first mountain on the left shows an example of rounding to the nearest 10. Show students the number 1,523 and have them say the number out loud. Explain to them that since we are rounding to the nearest 10 there is an arrow pointed to the two which is in the 10’s place.
4. On the line left of the mountain shows the number 1,520 then point to the numbers starting with 0 and continue all the way to 10 going around the mountain.
5. On the line right of the mountain shows the number 1, 530.

6. Explain to the students that the numbers written on the lines are the two different numbers they would choose when rounding 1,523 to the nearest 10. (the 10 before the number and the 10 after the number)
7. Sing the song “The Bear Goes over the Mountain” but instead of saying the bear say the digit to the right on the arrow. For example, sing: Did the three go over the mountain, did the three go over the mountain, did the three go over the mountain? No, we didn’t get up the mountain. So we know that this rounds to the number on the line closest to the three which is 1,520.
8. Repeat this with rounding to the nearest 100 and rounding to the nearest 1,000.
9. When rounding 1,523 to the nearest 1,000 your students may be confused because the number five is on top of the mountain. If you use the analogy of you holding a bowling ball and climbing the mountain. Once you got to the top would your momentum take you forward over the mountain or back down the mountain? Help them to understand that it would take you forward over the mountain, so it would round to 2,000.
10. Model using your rounding mountain sheet on the overhead before you hand out their sheet. I would model this until your class is ready to begin working on their own rounding mountain sheet.
11. Once students have practiced and have been assessed in using the rounding mountain sheet you can then begin introducing them to rounding with a number line.
12. Make an overhead of the *Number Lines* sheet.
13. Ask students to compare the rounding mountains to the number line. What is the same about the two different number lines and what is different about them?
14. Ask students the following question: Would you use the number line to round the same way you would use the mountain number line to round? Teach them that the rounding mountain has been stretched out to make a straight line which is now the number line.
15. Show the overhead of the *Number Lines* sheet.
16. The first number line on the left shows an example of rounding to the nearest 10. Show students the number 1,523 and explain to them that since we are rounding to the nearest 10 there is an arrow pointed to the two which is in the 10’s place.

17. The number line begins with 1,520 and ends with 1,530. Show the number 1, 525 and ask why do you think they have put that number on the number line? (it is half way)
18. Have students show where 1,523 should go on the number line and put a dot on the line and name the dot 1,523.
19. Repeat this with rounding to the nearest 100 and rounding to the nearest 1,000 on the number line.
20. Make sure you have modeled this and your students understand how to use the number line before you hand out the number line sheet.
21. Give each student the *Number Line* sheet and have them practice rounding.
22. Students have learned to round numbers using a rounded number line and a straight number line. Now introduce them to rounding without using a number line.
23. Put a number on the board or overhead (e.g. 123) and tell students you are going to round this number to the nearest 10.
24. Put an arrow underneath the two which is in the 10's place. Underline the number three which is the number on the right side of the two.
25. The number three is the controlling number or the "Boss". It decides if we are going to keep the two which is in the 10's place the same or bump it up to a three.
26. Write 120 to the left side of our number and write 130 to the right side of our number.
27. Remind students of the mountain number line and decide if the controlling number would go over the mountain or would go down the mountain.
28. The controlling number would go down the mountain, so 123 would round to 120.
29. Model this many times using different numbers and round to the nearest 10, 100 or 1,000.
30. When students understand this concept then pass out the white boards and markers.
31. Model with your students as they practice rounding on their own white boards.
32. Put students in groups or partners and have them practice rounding on their white boards.

Assessment Suggestions

- The teacher should walk around and make sure students are completing the *Rounding Mountain* sheet and the *Number Lines* sheet correctly.
- Have students hand in their *Rounding Mountain* sheet and Number Line sheet so you can assess their work.
- Another way to assess is by having students work together and to assess each others *Rounding Mountain* and *Number Lines* sheets.
- When students begin rounding on their white boards the teacher should walk around making sure that each student understands the concept of rounding.

Curriculum Extensions/Adaptations/Integration

- For advanced learners you can extend the Place Value Match-up game by including larger numbers. Students can play in groups so that you can adapt the game for each level in your classroom.
- For learners with special needs have them work together with a partner or group to complete their *Rounding Mountain* and number line sheet.
- An extension to the rounding activity with white boards is to make up number cards with three to five digit numbers. Underneath each number, write round to the nearest 10 or 100 or 1,000. Have students pair up in partners and give each partner 3-5 different cards. One partner would turn over a card and then each student would round their number on their white board. Then share it with their partner to see if they match. If they match turn over another card. If they don't match then help each other find the correct answer.
- Partner up your advanced learners and have them time each other to see how fast they can round their numbers. You can also have them race each other and the first one that completes their problem correctly gets a point.
- Advanced learners can round larger numbers to the nearest 10, 100 or 1,000. They can also round larger numbers to the nearest 10,000, 100,000 etc.

Family Connections

- Have students take home a *Rounding Mountain* and a *Number Lines sheet* and share what they have learned with their parents.
- Students can show their family members how they learned to round without using a number line. Those students who are advanced learners can race their parents or siblings when rounding different numbers to the nearest 10's, 100's, or 1,000's.
- Parents can help students create their own rounding game to share with the class.

Additional Resources

Articles

The Mailbox the Idea Magazine for Teachers, The Education Center; August/September 1997—Volume 19--Number 4—Intermediate

Web sites

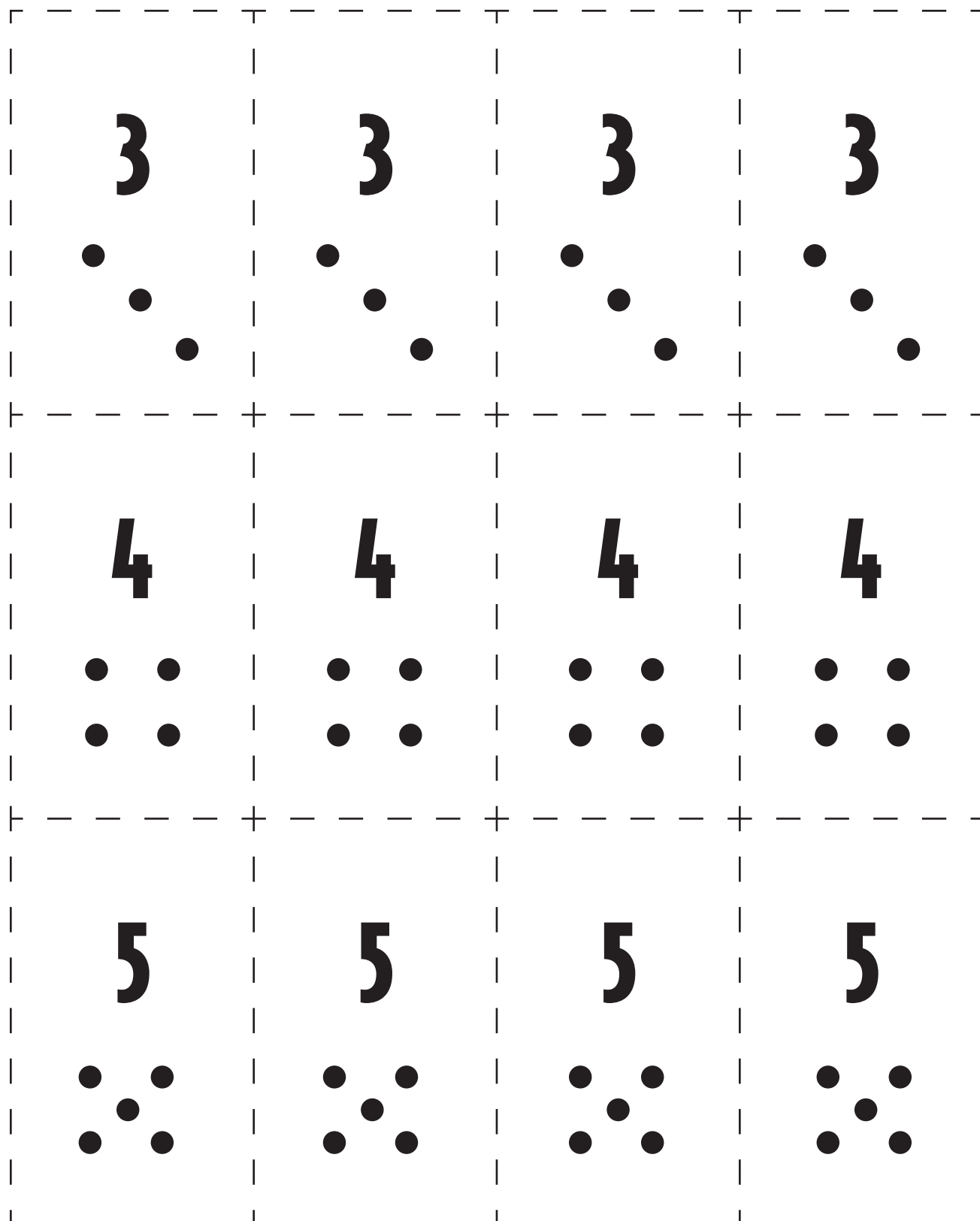
<http://www.themailbox.com>

<http://www.mathcats.com>

Digit Cards

0	0	0	0
1	1	1	1
2	2	2	2

Digit Cards



Digit Cards

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Digit Cards

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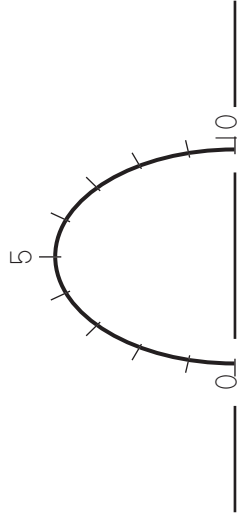
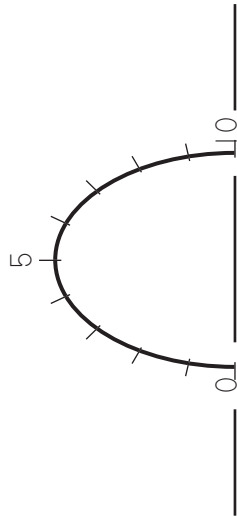
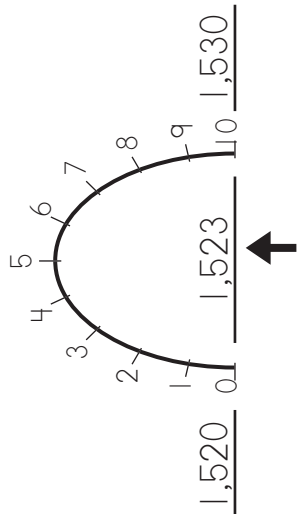
Place Value Cards

10,000s	10,000s
1,000s	1,000s
100s	100s
1s	1s

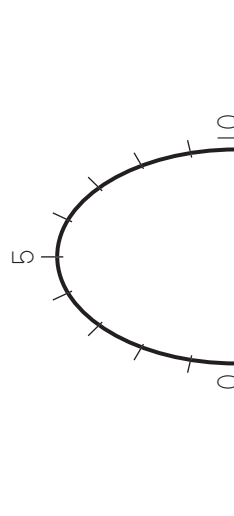
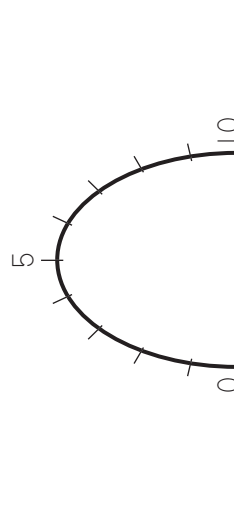
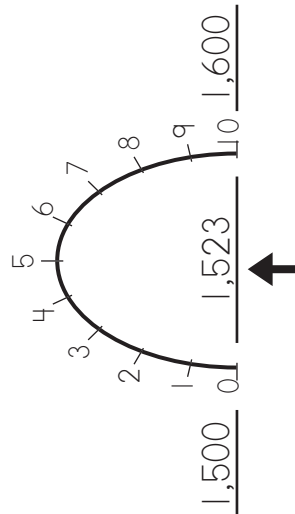
Name _____ Date _____

Rounding Mountains

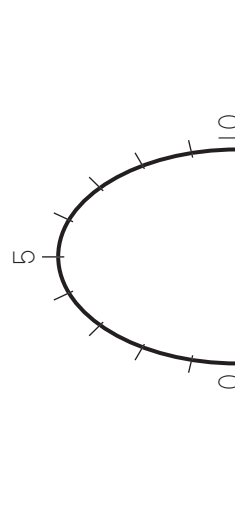
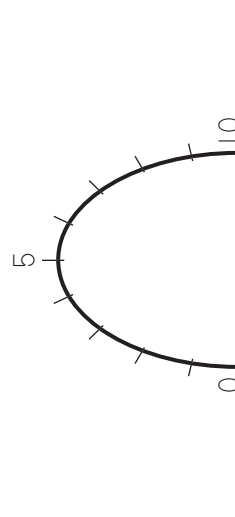
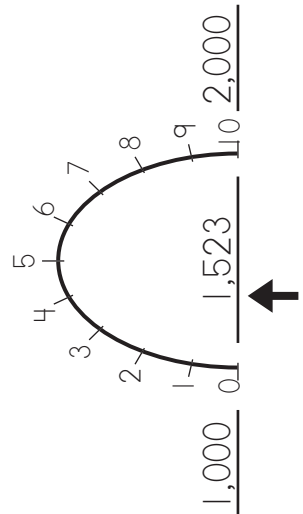
Round to the nearest 10



Round to the nearest 100



Round to the nearest 1000



Name _____ Date _____

Number Lines

Round to the nearest 10

1,523





1,525

Round to the nearest 100

1,523





1,550

Round to the nearest 1000

1,523





1,500

Place Value

Math Standard I

Objective 1

Connections

Standard I:

Students will understand the base-ten numeration system, place value concepts, simple fractions and perform operations with whole numbers.

Objective 1:

Represent whole numbers up to 10,000, comprehend place value concepts, and identify relationships among whole numbers using base-ten models and symbolic notation.

Intended Learning Outcomes:

1. Develop a positive learning attitude toward mathematics.
4. Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.
6. Represent mathematical ideas in a variety of ways.

Content Connections:

Language Arts VII-2; Listening skills
Math IV-1; Measurement

Background Information

Students should be able to know and understand what basic whole numbers are and what they look like. They should have some understanding of place value and what it represents in a whole number. They should be taught specific vocabulary relating to the lesson before you begin. This should include: Numeral, digit, standard form, expanded form, ones, tens, hundreds, thousands, ten thousands, and horizontal and vertical lines. It would be very helpful if you could show them pictures or examples of each vocabulary word listed above. They should be taught and understand how numbers are used in the world and how important the use of learning to read and write numbers is beneficial in their daily life.

Research Basis

Ball Loewenberg, D., Research on Teaching Mathematics: Making Subject Matter Knowledge Part of the Equation. Greenwich, CT: JAI Press.

In order to teach mathematics effectively, teachers must understand mathematics themselves? This articles research shows that past efforts to show the relationship of teachers' mathematical knowledge to their teaching mathematics have been largely unsuccessful. The author researches what it means to understand mathematics and the role played by such understanding in teaching.

Baxter, J. A., Woodward, J., (2005). Writing in Mathematics: An Alternative Form of Communication for Academically Low-Achieving Students. *Learning Disabilities Research and Practice*. 20(2), 119-135.

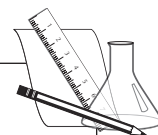
In this study they analyze how one teacher used writing to support communication in a seventh-grade, low-track mathematics class. For one school year, they studied four low achieving students in the class. Students wrote in journals on a weekly basis. Using classroom observations and interviews with the teacher, they developed profiles of the four students, capturing their participation in class discussions. The profiles highlighted an important similarity among the four students: marginal participation in both small-group and whole class discussions. However, their analysis of the students' journals identified multiple instance where the students were able to explain their mathematical reasoning, revealing their conceptual understanding, ability to explain, and skill at representing a problem.

Invitation to Learn

This activity is called “Match Game”. Each student will receive a card. On the card there will be a numeral or place value blocks. Students will walk around and find their match. Those students with numeral cards will be looking for the person that has the same value on their card that is represented by place value blocks. Those students with place value blocks will be looking for the person that has the same value on their card but is represented by numerals. Once they have found their match they say the number with their partner. They then find another set of partners and they both share their numbers with each other. They return to their seats and write their number in their journal in standard form, expanded form and word form. They can then use their stamps to put the place value blocks for that number in their journal.

Materials

- ☐ Place Value Stamps
- ☐ Ink Pad
- ☐ Numeral cards
- ☐ Place value block cards



Instructional Procedures

Places, Everyone

1. Each student should receive a copy of the *Place Value Houses*.
2. The teacher should have a copy of the *Place Value Houses* on an overhead.
3. Have students cut out their *Place Value Houses* and glue them in their journal.
4. Teach students what each house represents. The first house on the right is called Units that have the values of ones, tens

Materials

- ☐ Place Value Houses
- ☐ Single digit card
- ☐ Place Value Chart
- ☐ White paper
- ☐ Numeral Strips
- ☐ Overhead markers



and hundreds. The second house is called Thousands with the values of ones, tens and hundreds and the third house is called Millions with the values of ones, tens and hundreds. Each house will have a group of three digits in a number. Each group is called a period. Explain to students that within each period the names are the same: hundreds, tens, and ones.

5. Write a four or five digit number on the overhead or chalkboard. (e.g. 6, 348 or 45, 823). Model how to say this number by pointing to where each number would be represented on the houses. Explain to students that when reading or writing a large numeral, it is helpful to break it down into periods and read each period as a simple one, two or three digit numeral. Also help students see that the commas between each house represent pauses when reading a numeral, just as they do in reading text. Whenever a student comes to a comma in reading or writing a large numeral, he knows to pause and say or write a period name. It is very important when you are modeling that you do not say “and” when reading the number. “And” represents a decimal, so when reading 6,348 you would not say six thousand three hundred and forty eight you would say six thousand three hundred forty eight. Model a few numbers to show students how to read large numbers. After you have modeled it a few times have students begin to say and point to the numbers that would be represented on their place value house chart.
6. Write a number on the overhead or chalkboard that has a 0 (e.g. 35, 207). Explain to students that the value of the first digit’s place determines how large the numeral will be and that any empty place to the right of the digit must have a zero place holder. Read this number to the students and point to where each digit would be represented on the place value house chart. Explain that even though you didn’t say anything for the zero in the tens place it is very important that they don’t forget to put it in when writing the number. Each place value on any digit has to be represented by a numeral.
7. Divide the class into two groups
8. Give each student in each group a single digit card. (0-9)
9. Teacher reads a number (e.g. 12, 543) and the students arrange themselves in the proper order. Each student in the group will help each other to form the number. Once they have formed the number they raise their hand to show they have completed the number. The teacher then asks them to say the number out

loud. You can continue this activity having them create many different numbers with their cards. (See extensions for more ideas to use with this activity.)

10. After each number they create they can write that number in their journal in standard form, expanded form and word form. They can also use the place value stamps to create the number.
11. Next, you will need a *Place Value Chart* there is a black line or your students can make their own by following these simple steps.
 - a. Lay a sheet of paper horizontally, fold one side in thirds and crease it and fold the other side in thirds and crease it.
 - b. Open up your sheet. Draw lines along the two vertical creases.
 - c. Measure and draw a horizontal line one inch from the top edge of your sheet.
 - d. Beginning on the left side, label the four resulting boxes: Millions, Thousands, and Units.
 - e. Measure and draw another horizontal line $\frac{1}{2}$ inch below the first one.
 - f. Beginning on the right side of the paper, measure and draw a vertical line $1\frac{1}{4}$ inches from the edge. Extend this line from the first horizontal line down to the bottom edge of the paper.
 - g. Measure and draw another vertical line $1\frac{1}{4}$ inches from the first one. Extend this line from the first horizontal line down to the bottom edge of the paper.
 - h. From left to right, label the three resulting small boxes “H” (hundreds), “T” (tens), and “O” (ones).
 - i. Continue measuring and drawing vertical lines ($1\frac{1}{4}$ inches apart) across the paper so that the thousands and millions sections are exactly like the units section.
 - j. Label the three column headings (“H”, “T”, and “O”) in each section.
 - k. If you want a pocket at the bottom to hold number strips just fold the bottom up $1\frac{1}{2}$ inches and tape or glue on each end.
12. Once they have their place value chart made you can laminate it and use overhead markers and/or use the *Place Value Strips*.
13. Read a number to them and have them place their *Place Value Strips* in the correct order to create the number provided.

14. Next have students go to a journal and write the number in standard form, expanded form, and word form. They can also use their place value stamps and stamp them in their journal to create the number given.
15. Students can work with partners and they can create numbers together or one partner can say a number and the other would create it on their place value chart.

Assessment Suggestions

- Teachers should walk around and assess the students to see if they are creating the numbers she has given them correctly.
- Students can say and point to the place value of each numeral, to the teacher, so she can see if they understand.
- Another way to assess would be to check the student's journal to see if they understand the concepts taught.
- Have students work together and assess each other's journals.

Curriculum Extensions/Adaptations/Integration

- For advanced learners extend the place value house activity by using larger numbers and have students practice saying and writing numbers to the millions.
- Some extensions you could use with the single digit cards would be to have each group make the smallest number with their cards and then have them make the largest numbers with their cards. Next have them make a number with the value of 8 in the 10,000 place or a number with a value of 3 in the hundreds place. Have them say and write the numbers that they create.
- For advanced learners make another place value chart with four periods which include units, thousands, millions and billions. They can work with partners and create different numbers on their own.
- For students with special needs have them pair up with a partner and work together on each of the activities.
- You can extend these activities by taking two numbers and comparing the numbers. Use the symbols $<$, $>$, $=$ and \neq . Teach the vocabulary greater than, less than, equal to and not equal to.

Family Connections

- Students can work with their parents at home by having a parent say a number and the child writes it down in standard form, expanded form and word form.
- Students can take home a copy of the *Place Value Houses* and the parent can write down a number and the child would say the number and point to the value of each numeral on the house.
- Students could take home their journal and share their place value activities with their parents.
- Parents can work with students on comparing numbers by writing two different numerals down and having the child pick the correct symbol that would go between each numeral.

Additional Resources

Articles

The Mailbox the Idea Magazine for Teachers, The Education Center; August/September 1997—Volume 19--Number 4—Intermediate

Books

Place Value (Kid Friendly Computation), by Sarah Morgan

Web sites

<http://www.themailbox.com>

<http://www.mathcats.com>

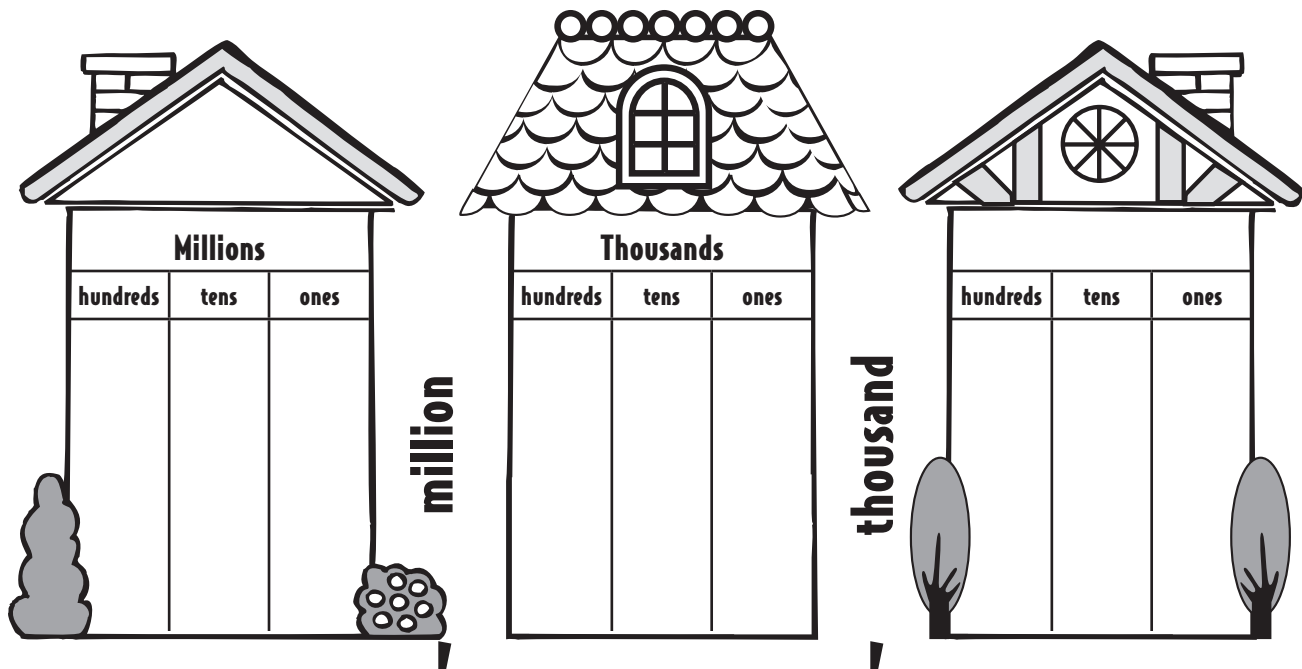
<http://www.uen.org>

<http://lessonplanspage.com>

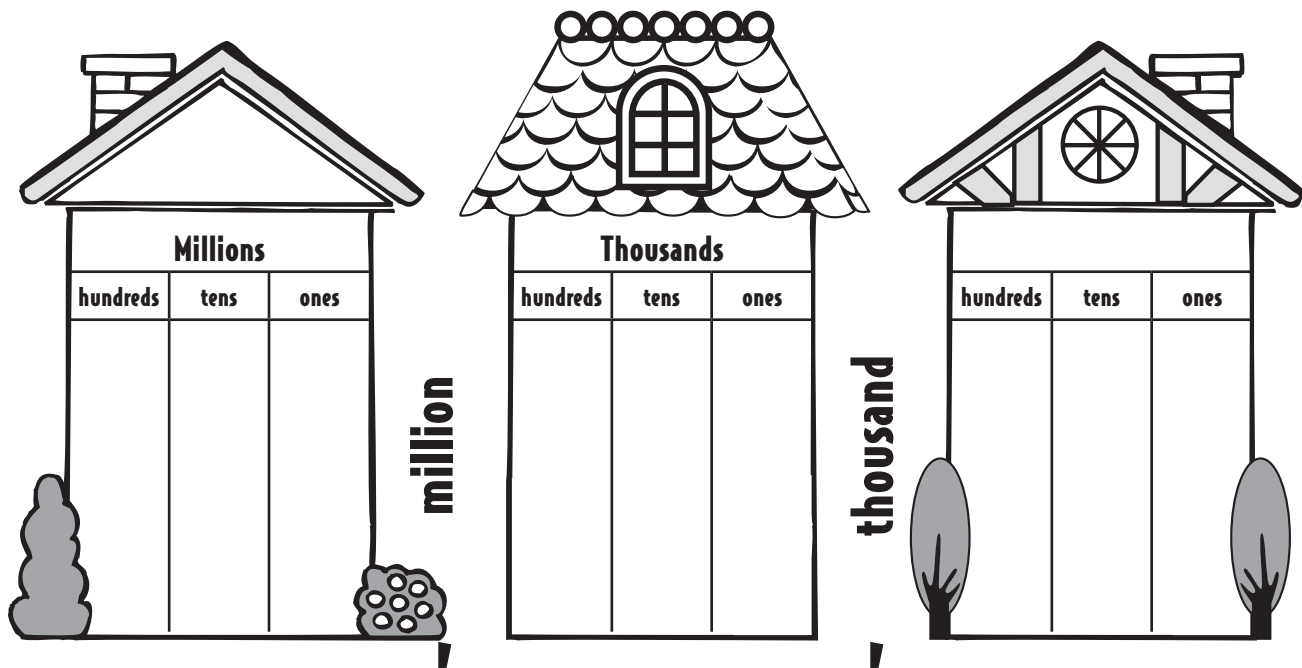
Games

Place Value Quizmo

Place Value Houses



Place Value Houses



Numeral Strips

0	1	2	3	4	5	6
7	8	9	0	1	2	3
4	5	6	7	8	9	

Science V

Activities

H e a t & L i g h t

Our Friend, the Sun

Standard V:

Students will understand that the sun is the main source of heat and light for things living on Earth. They will also understand that the motion of rubbing objects together may produce heat.

Objective 1:

Provide evidence showing that the sun is the source of heat and light for Earth.

Intended Learning Outcomes:

1. Use Science Process and Thinking Skills
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Content Connections:

Math V-1; Collect, organize, and display data

Science
Standard

V

Objective

1

Connections

Background Information

The sun is an average-sized star that has been burning for about 4.6 billion years. The distance from the sun's center to its surface is about 695,500 kilometers (432,000 miles), approximately 109 times the radius of Earth. The interior of the sun reaches temperatures of more than 15,000,000 degrees C, (27,000,000 F). It is a nuclear furnace producing energy, free of pollution. Although 4,000,000 tons of the sun's matter turns into energy every second, only one-billionth of the sun's light and heat ever strikes Earth.

The sun is the center of our universe. Earth and other planetary systems revolve around the sun. The sun appears to move across the sky from east to west because of Earth's counterclockwise rotation. As Earth rotates and the part of Earth we are on turns towards the sun, we see it appear to rise above the horizon. We also experience seasons and varying amounts of daylight, caused by the 23 ½ degree tilt of the Earth as it revolves around the sun. The moon does not produce any heat or light. The moon's light we experience on Earth is reflected sunlight off the moon's surface.

The sun is Earth's main source of heat and light. Heat and light from the sun's rays is called solar energy and is essential for life on Earth. The warming of Earth's atmosphere is called the greenhouse effect. Earth's climate is warming in response of atmospheric accumulation of heat-trapping gases, such as carbon dioxide (CO²). CO² is produced from power plants and burning fossil fuels, and it is responsible for about half of the warming of the climate. The other main gases responsible for the greenhouse effect are nitrogen oxide

(N₂O) produced by automobile exhaust, methane (CH₄) produced by decaying plants and animals, rotting garbage, humans and animals passing gas, chlorofluorocarbons (CFCs) found in refrigerators, air conditioners, foamed plastics, and other man-made products.

Over the past few centuries, people have been burning more amounts of fuel, such as wood, coal, oil, natural gas, and gasoline. The result, some experts believe, will be Earth heating up and undergoing global warming. Some scientists believe the build up of CO₂ in the atmosphere may be caused by deforestation, which reduces the number of trees available to absorb CO₂. Some solar scientists are considering whether the warming exists, wholly or in part, by a small increase in the Sun's energy output. An increase of only 0.2% in the solar output could have the same effect as doubling the carbon dioxide in Earth's atmosphere. Many fear that the rise in temperature of the Earth's atmosphere will disrupt weather patterns, causing the polar icecaps to melt and release more water into the oceans. This increase in the water level might cause the ocean's saline concentration to weaken, threatening marine species and flooding coastal areas.

Research Basis

Lasley, T.J. & Matczynski, T.J. (1997). *Strategies for Teaching in a Diverse Society: Instructional Models*

Only teachers who utilize a variety of instructional models will be successful in maximizing the achievement of all students. Teachers need to “play to” students’ strengths and to mitigate students’ learning weaknesses. This can be done only through the use of instructional variety.

Danielson, C., (2002). *Enhancing Student Achievement: A Framework for School Improvement*, pp. 73

Only by building and strengthening links with other institutions in the community can schools achieve their full mission. Local individuals and organizations – families and caregivers, public and private agencies, the business community, and colleges and universities – should not be regarded as competitors, but rather as partners in the education of the community's children.

Invitation to Learn

Let the Sun Shine

This activity will introduce the students to the sun as they discover how life on Earth benefits from solar energy.

Prior to this activity, you must collect the following “props” and place them in a box at the front of the room: sunglasses, teddy bear, hand fan, picture of the sun, flashlight, hand mirror, plastic stemmed flower, umbrella, Frisbee, bottle of sunscreen, “Sun”, “Earth”, and “Moon” nametags.

Cut apart and distribute parts from *Let the Sun Shine* master to the students. Allow them to read their parts in advance so they are comfortable with their actions and script.

Stand back and let them perform.

- As a differentiated variation, students could make their own version of this activity using a single concept from their study of the sun. They could present concepts such as “How the sun affects plant life” or “Fossil Fuels – A Gift from the Sun”. Let them perform for another class or at a parents’ night.

Extension

- This activity may also be used as a culminating “celebration” for their study of the sun.
- Each student will draw and label a picture representing their part from *Let the Sun Shine*. These pictures can be combined to make a classroom banner.
- Students will journal what they have learned about the effects of the sun.

Instructional Procedures

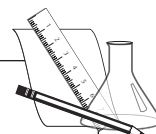
Solar Panning

We will discover the effects of heating water in different containers using solar energy. Students will discover how container size, color, and materials change the effects of solar energy. When setting up the experiment it is important to maintain constant variables except for those that are being tested. Constant (or controlled variables) would be such things as: the amount of water measured; the amount of time used conducting the experiment, the type of ground surface, etc. Manipulated (or independent) variables are those things we change in response to our intended hypothesis, such as: the size of pans, the pan’s color, the pan’s material, or the pan’s location in relation to the amount of solar energy available.

1. Each group will need 4 aluminum loaf pans: 3 identical pans and 1 different-sized pan

Materials

- ☐ Solar Panning
- ☐ Thermometers
- ☐ Aluminum loaf pans
- ☐ Spray paint
- ☐ Graduated cylinder
- ☐ Plastic wrap
- ☐ Tape
- ☐ Scissors



2. Spray paint 2 identically-sized pans - one black and the other white, allowing time to dry.
3. Using a graduated cylinder, measure and pour 150 ml (or 2/3 cup) of lukewarm water into each of your 4 pans.
4. Place thermometers into each pan and record your initial temperature using the *Solar Panning* recording sheet.
5. Immediately cover each pan with clear plastic wrap and tape in place, leaving the thermometer inside.
6. Before placing your pans in the sun, predict how each container will absorb solar energy and record your predictions on your *Solar Panning* recording sheet.
7. Choose a level, sunny location for your pans where they should be free of human interference for a 30-minute period. Place the 2 corresponding pans together where they will receive similar solar energy.
8. Record the temperature in each pan at 10 minute intervals and observe any changes taking place on your worksheet. Replace the plastic wrap after each temperature reading.
9. At the end of 30 minutes, record your final temperature.
10. Journal and graph the results of this activity. Share your group results as you discuss the following questions.

Did your experiment conclusions match your predictions?

Why were 2 corresponding pans needed? Why were the pans covered? Did the container size matter in the collection of solar energy? How did the color of containers affect the results? How could a different location of the pan in the sunlight change the results? Would you expect to obtain the same results throughout different times of the year?

- As a differentiation activity, allow the students the opportunity to choose the containers and variables they wish as they explore the collection of solar heat. Encourage them to present their findings in unique, meaningful ways to the class.

Extension

- Use similar loaf pans of different materials (glass or plastic) and observe your results.
- Experiment with colored liquids in the loaf pans. Which colored liquid absorb more solar energy?
- Place one pan in direct sunlight and the other in the shade. Record the results.

- Cover one pan with plastic wrap and leave the second pan uncovered. What effect does the plastic wrap have on the rate of heat absorption?

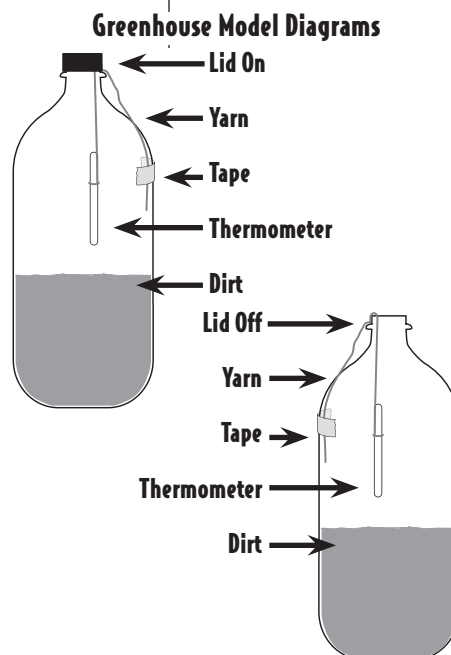
Greenhouse Model

1. Explain to the class how CO² is the greenhouse gas responsible for about half of the warming of our climate. If we put too much CO² in the atmosphere it could contribute to Earth's temperature rise. Have the class identify problems related to global warming and list them on the board.
2. Take the lid off a plastic 2-Liter bottle and place the funnel in the top.
3. Place spoonfuls of topsoil in the funnel until the bottom of the bottle has several inches of dirt.
4. Pour 2 to 3 spoonfuls of water in the funnel – just enough to moisten the soil.
5. Tie a 12 inch piece of yarn to one of the thermometers.
6. Remove the funnel from the bottle and lower the thermometer by the yarn until it is directly above the soil.
7. Tape the other end of the yarn to the outside of the bottle.
8. Replace the lid. This capped bottle will represent Earth undergoing global warming.
9. Repeat steps 2-7 using the other 2-Liter bottle.
10. Do not replace its lid. This bottle represents a planet that does not have the heat-trapping greenhouse gases.
11. Place your 2 bottles in direct sunlight.
12. Check your thermometers every 30 minutes for 2 hours and record your findings in your journal.
13. If using heat lamps instead of placing the bottles in direct sunlight, check your thermometers and record your findings every 10 minutes for 40 minutes.

Did you record the same temperature on both thermometers? Can you explain why these two temperature results are different? The open bottle allows heated gases to escape, providing a lower temperature than the bottle with the lid. The air above the open bottle is constantly changing, and as air in this bottle is heated and rises, it is being replaced by cooler air. The air in the closed bottle cannot circulate with air from the outside. The temperature of the

Materials

- ☐ 2-liter bottles
- ☐ Yarn
- ☐ Thermometers
- ☐ Potting Soil
- ☐ Water
- ☐ Spoon
- ☐ Funnel
- ☐ Tape
- ☐ Permanent Marker
- ☐ Sunny area



air in this closed bottle continues to increase as it receives more and more solar energy.

Assessment Suggestions

- Check student temperature charts, drawings, and journals for student understanding.
- Students will share activity results orally with those in their group or with the class.
- Assess student drawings and classroom banner from *Let the Sun Shine* activity.
- Use a rubric for scoring the *Solar Panning* activity.
 - 4 correct, complete, detailed
 - 3 mostly correct & complete, fairly detailed
 - 2 partially correct & complete, lacks some detail
 - 1 incorrect, incomplete, missing important detail
 - 0 no attempt

Curriculum Extensions/Adaptations/Integration

- As a literature connection, read the book *Heat Wave* by Helen Kettelman. Have the students write and illustrate their own imaginative endings of how they could stop a heat wave. You could compile all student entries into a class book. They could also make a variation telling how they could cause a heat wave to appear during a devastating cold spell.
- After student research about the Greenhouse effect, students could write persuasive letters to businesses contributing to pollution informing them of measures they could take that would help improve air and water quality. They could write letters to government officials encouraging them to support bills and enact laws that would protect the environment.
- Students could create posters that urge people to take care of Earth.

Family Connections

- You can also demonstrate the greenhouse effect by taking 2 similar ice cubes. Place each ice cubes on a small plate. Over one of the ice cubes, place a clear, plastic cup. Leave the other

cube uncovered. Set them both in direct sunlight. Observe the melting rate of each ice cube. Which ice cube melted more rapidly? Explain how the melting of the covered ice cube demonstrates the greenhouse effect?

- Ask the students if they have ever sat inside a parked car in the sunlight with the windows closed. The heated air from the sunlight gets trapped inside the car. This is an example of the greenhouse effect. Remind students how dangerous this can be on a hot day. The temperature inside a closed car can reach over 120 degrees F (49 degrees C) in a matter of minutes.

Additional Resources

Books

Energy Makes Things Happen, by Kimberly Brubaker Bradley (Let's-Read-and-Find-Out Science); ISBN 0-06-445213-1

Experiments With the Sun and the Moon, by Salvatore Tocci (A True Book Series); ISBN 0-516-22605-3

Heat Wave, by Helen Ketteman; ISBN 0-8027-7577-2

Sun, by Dana Meachen Rau; ISBN 0-7565-0440-6

The Sun, by Dan Elish (Space Group 2); ISBN 978-0-7614-2048-4

The Sun, by Margaret J. Goldstein (Lerner Publications Company); ISBN 0-8225-4647-7

The Sun: Our Nearest Star, by Franklyn M. Branley (Let's-Read-and-Find-Out Science); ISBN 0-06-445202-6

The Sun, by Isaac Asimov (Isaac Asimov's 21st Century Library of the Universe); ISBN 0-8368-3242-6

What if the Polar Caps Melted? by Katherine Friedman (What If? Series); ISBN 0-516-23914-7

Media

All About Light, Physical Science for Children Series, (Schlessinger Science Library) Library Video Company VHS DK7109, DVD DV8854

Bill Nye the Science Guy Series Three – The Sun, (Disney Educational Productions) Library Video Company VHS DN2248, DVD DW0599

All About the Sun – Space Science for Children, (Schlessinger Science Library) Library Video Company ISBN 1-57225-234-0

Web sites

The Sun: Man's Friend & Foe, <http://library.thinkquest.org>

NASA Explores Just For Fun, <http://www.nasaexplores.com/fun.php>

Windows to the Universe – Beginner Fun & Games, <http://www.windows.ucar.edu/>

NASA's Observatorium, <http://observe.arc.nasa.gov/nasa/core.shtml.html>

Stanford's Solar Center, <http://solar-center.stanford.edu>

National Arbor's Day Foundation Carly's Kids Corner, <http://www.arborday.net/kids/carly/>

Let the Sun Shine

Materials Needed:

Large box
Sunglasses
Hand Fan
Teddy Bear

Sun Picture
Flashlight
Hand Mirror
Frisbee

Umbrella
Sungscreen
Stemmed Flower
Nametags for "Earth" "Sun"
"Moon"

#1

Skip to the front of the room, take a deep bow, and yell, "*We would like you to meet our hero, the Sun.*" Then skip back to your seat.

#2

When you hear someone say, "Our hero, the sun," run to the classroom door and look out into the hallway. Place your hand horizontally above your eyes as if looking far away and yell, "*Where is the sun?*" Then give a puzzled look, scratch your head, and return to your seat.

#3

When someone asks, "Where is the sun?" flap your arms like a bird as you fly towards a window and yell, "*Everyone knows you can find the sun outside!*" Chirp like a bird as you fly back to your seat.

#4

When someone chirps and flaps their arms like a bird, run to the box, take a pair of sunglasses out, and run to the right side of the room. Put the sunglasses on and ask, "*Why is the sun so bright?*" Do *not* return back to your seat.

#5

When you see someone wearing sunglasses, run to the box and find a fan. Run to the left side of the room, fanning yourself and ask, "*Why does the sun feel so hot?*" Continue fanning yourself. Do *not* return back to your seat.

#6

When you see someone fanning themselves, come to the front of the room carrying your chair. Find the teddy bear in the box. Stand on your chair, snuggling the bear and ask, "*Where does the sun go at night?*" Continue standing on your chair with your bear. Do *not* return back to your seat.

#7

When you see someone holding a teddy bear, walk proudly to the front of the room taking bows. Find the picture of the sun in the box. Hold it high above your head and yell, *“I am the sun. Listen to my story as I answer all of your questions. Come with me!”* Place the picture of the sun on the chalkboard and lead the 3 kids back to their seats.

#8

When you see someone place a picture of the sun on the chalkboard, slowly walk to the front of the room wiggling the fingers of both hands high above your head. Write the words, “A STAR” in large letters on the chalkboard and say, *“The Sun is a medium-sized star. It appears bigger and brighter than other stars because it is so close to the Earth.”* Return to your seat walking passed the front row of students. Lean very close to each one and whisper the words, “Close, close, close . . .” over and over.

#9

When you see someone write the words “A STAR” on the chalkboard, run to the front of the room. Find the “Sun” nametag and a flashlight in the box. Put it on, turn on the flashlight, and shine it towards the class. Yell the words, *“The sun is like a huge furnace of burning gases. Hydrogen is the sun’s fuel.”* Continue standing there. Do *not* go back to your seat.

#10

When someone says, “Hydrogen is the sun’s fuel”, stand where you are and yell, *“The temperature inside the sun reaches millions of degrees, much hotter than any place on Earth.”* Wipe one hand across your forehead and say, *“Is anyone else feeling a little toasty in here?”* Sit back down.

#11

When someone asks, “Is anyone else feeling a little toasty I here?” spread your arms out like the wings of a spaceship, lower your head, and fly toward the “Sun” making loud rocket sounds. When you reach the “Sun”, stop and yell, *“The sun is so hot that a spaceship would be instantly destroyed by its intense heat before it could even get close.”* Then act like a melting candle as you shrink in size repeating the words, *“I’m melting! I’m melting!”* Return to your seat.

#12

When someone says, “I’m melting! I’m melting!” run to the front of the room. Find and put on the “Earth” nametag. Stand about 5 feet away from the “Sun” and yell, *“The Sun is the center of our solar system. The Earth is one of the 9 planets that orbit, or circle the sun.”* Do *not* go back to your seat.

<p>#13</p> <p>When someone says, “The Earth is one of 9 planets that orbit the sun,” stand where you are and yell, “<i>Although the Earth is 93 million miles away from the sun, it still receives the sun’s energy. This energy comes to us as heat and light.</i>” Sit back down.</p>	<p>#14</p> <p>When someone says, “This energy comes to us as heat and light,” gallop around the perimeter of the room. When you reach to the front of the room, stop and yell, “<i>The Earth travels, or revolves, around the sun in a path called an orbit. One complete orbit makes a year, about 365 days on Earth. That’s a pretty long trip!</i>” Gallop back to your seat.</p>
<p>#15</p> <p>When someone gallops back to their seat, carefully come to the front of the room, spinning yourself round and round. When you reach the front, put one finger on top of “Earth’s” head and slowly spin them around several times. Stop “Earth” and yell, “<i>The Earth spins, or rotates, as it orbits around the sun. One complete rotation takes 24 hours on Earth, making a day. Our Earth never stops spinning!</i>” Return to you seat spinning around.</p>	<p>#16</p> <p>When someone says, “Our Earth never stops spinning,” stand on your chair and crow loudly like a rooster flapping your arms. Then yell, “<i>For 12 hours one side of the Earth faces the sun. During these daytime hours we can see the sun’s light and feel its heat.</i>” Crow once again like a rooster and sit down.</p>
<p>#17</p> <p>When someone crows like a rooster and sits down stand on your chair and loudly whoo, whoo, whoo like an owl. Then yell, “<i>As the Earth rotates the next 12 hours, it faces away from the sun. During these nighttime hours the sun’s heat or light does not reach that side of the Earth.</i>” Whoo once again like an owl and sit down.</p>	<p>#18</p> <p>When someone whoos like an owl and sits down, run to the front of the room. Find the mirror and the “Moon” nametag and put it on. Stand beside the “Earth” holding the mirror so it faces the “Sun” and yell, “<i>The moon does not produce any heat or light of its own. Light from the sun reflects, or bounces off the moon’s surface like a mirror.</i>” Look up above the “Moon” and say, “<i>Did I just spy a leaping cow?</i>” Make “mooing” sounds like a cow and stampede back to your seat.</p>

<p>#19</p> <p>When someone “moos “ and runs like a cow back to their seat, run to the front of the room, do a cartwheel, and yell, “<i>We know how the Earth and the moon receive the sun’s energy; but how does its heat and light helps us?</i>” Motion toward the “Sun”, “Earth”, and “Moon” with your hand for them to follow you and say, “<i>Empty your hands and return to your seats.</i>” Do another cartwheel and together return to your seats.</p>	<p>#20</p> <p>When you see someone doing a cartwheel as they return to their seat, run around the classroom yelling, “<i>Our sun is continually producing solar energy that is sent out into space. It will continue radiating heat and light for millions of years. Unlike me, it never gets tired of working.</i>” Stop running and slowly crawl back to your seat.</p>
<p>#21</p> <p>When you see someone crawling back to their seat, run to the front of the room, curl up in a small ball, and slowly stretch upward like a seed growing towards the sun. Then yell, “<i>The sun’s heat and light helps green plants grow. The green plants store some of the sun’s energy in their leaves as food.</i>” Spread your arms out and lazily float like a leaf back to your seat.</p>	<p>#22</p> <p>When someone says, “Green plants store some of the sun’s energy in their leaves as food,” crawl like an inchworm arching your back to the right side of the room and yell, “<i>Animals get their energy by eating green plants. Caterpillars nibble leaves, taking in the stored solar energy from the green plants they eat as food.</i>” Crawl like an inchworm back to your seat.</p>
<p>#23</p> <p>When you see someone crawling like an inchworm, hop to the left side of the room like a frog saying “Ribbit, ribbit, ribbit . . .” Then yell, “<i>Many animals eat one another for food. Each animal receives some of the stored energy from the sun as a part of the food chain.</i>” Return to your seat hopping like a frog.</p>	<p>#24</p> <p>When you see someone hopping like a frog, dance to the front of the room and say, “<i>The food people eat comes either from plants or animals. This way we also receive some of the sun’s energy that was stored in all of the fruits, vegetables, and meats we eat. We should thank the sun every time we enjoy a good meal.</i>” Dance back to your seat.</p>

<p>#25</p> <p>When you see someone dancing back to their seat, carefully stand on a table in the room and roar like a dinosaur. Then yell, <i>“Millions of years ago when dinosaurs roamed the Earth, it was covered with swamps and jungles. As these plants and animals grew they stored solar energy.”</i> Roar again like a dinosaur but do <i>not</i> return to your seat. Wait and follow the person making car sounds back to your seat.</p>	<p>#26</p> <p>When you see someone roar like a dinosaur, walk to the front of the room and find the flower in the box. Walk over to the “dinosaur”, hold the flower in front of you, and sadly say, <i>“When the dinosaurs died, they slowly changed to coal, oil, and natural gas. Today, we use the stored-up solar energy in the fossil fuels that run our cars, airplanes, and rockets.”</i> Make the sound of a car engine and drive yourself back to your seat.</p>
<p>#27</p> <p>When you see someone making car noises and driving back to their seat, form a big circle with your outstretched arms, blow air as you twirl around like a tornado around the room. When you reach the back of the classroom, stop and yell, <i>“Our weather and climate depend upon the sun. As the sun’s heat warms the Earth’s land and oceans, heated air rises, causing winds.”</i> Twirl your way back to your seat.</p>	<p>#28</p> <p>When you see someone twirling like a tornado, run to the front of the room, find and open the umbrella, and yell, <i>“Water vapor rises into the air as the sun heats oceans and lakes. When this moisture cools, it returns to the Earth as rain, snow or hail. The Earth’s water cycle provides needed moisture for all living plants and animals.”</i> Close the umbrella and return to your seat.</p>
<p>#29</p> <p>When you see someone close an umbrella, run to the front of the room with a partner, take the Frisbee in the box, and run to the right side of the room. When your partner has run to the left side of the room, toss the Frisbee back and forth with them as you say, <i>“We all enjoy the sun’s warmth and light as we play outdoors.”</i> Wait until your partner has finished their part. Then return the Frisbee and return to your seat.</p>	<p>#30</p> <p>When you see someone close an umbrella, run to the front of the room with a partner, find the sunscreen in the box, and run to the left side of the room. Toss the Frisbee with your partner as they say their part. Then put some sunscreen on your face and yell, <i>“We must remember that the sun produces harmful UV rays that can damage our skin. Wearing proper clothing and sunscreen helps protect us from harmful UV rays when we are exposed to the sun’s light for long periods of time.”</i> Return the sunscreen and return to your desk.</p>

<p style="text-align: center;">#31</p> <p>When you see Frisbee players return to their seat, run to the front of the room and yell, <i>“For millions of years, the sun has warmed and lighted our planet. It will continue shining bright and warm for many more millions of years, providing the energy needed for all living things.”</i> Take a deep bow and return to your seat.</p>	<p style="text-align: center;">#32</p> <p>When you see someone take a deep bow and return to their seat, stand up where you are and yell, <i>“Let’s all stand up and cheer loudly, as we thank our hero, the Sun.”</i> Everyone stands and goes crazy cheering.</p>

Name _____ Date _____

Solar Panning

Question: How will varying the size of pans affect the rate of solar heat absorption?

Hypothesis: I think _____

Record the temperature of the water in both pans as you first place them in the sun. Then continue to record the temperature of the water in your pans every 10 minutes.

Small Pan

Larger Pan

Time

Temp.

Temp.

What is your conclusion? _____

Question: How will varying the color of the pans affect the rate of solar heat absorption?

Hypothesis: I think _____

White Pan

Black Pan

Time

Temp.

Temp.

What is your conclusion? _____

In which pan did the water temperature increase the most? _____

What would be the most effective size and color for a solar heat absorption container? Why?

Managing Heat

Standard V:

Students will understand that the sun is the main source of heat and light for things living on Earth. They will also understand that the motion of rubbing objects together may produce heat.

Objective 1:

Provide evidence showing that the sun is the source of heat and light for Earth.

Intended Learning Outcomes:

1. Use Science Process and Thinking Skills
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Content Connections:

Math V-1; Collect, organize, and display data

Science
Standard

V

Objective

1

Connections

Background Information

Something that is hot, like a hot drink, feels very different from something cold, like ice cream. Both sensations are caused by the same thing: heat. The difference is that the cold object contains less heat than the hot ones. Our bodies make heat from our food. We also get heat from the Sun and from burning fuels. The heat of an object is measured using temperature. A thermometer measures temperature.

Many students have the misconception that a coat or glove can produce heat. Heat is the flow of energy from hotter to cooler objects. Coats and gloves help stop the flow of energy and trap, or hold the heat. Insulators are materials that block the flow of heat, so warm things tend to stay warm while cold items stay cool longer. Good insulators are plastic, feathers, air, and materials that hold air. Heat conductors are materials that allow the flow of heat energy to move easily from one source to another. Good conductors are solid materials such as metals.

The body of a polar bear is made for living in its harsh, cold environment. Among land animals, the polar bear is the largest predator in the world, with an average male measuring about 8 feet long and weighing between 800 to 1300 pounds. Large bodies usually hold heat much better than smaller ones. But the bear's large body also has extra layers of protection against the cold. Although a polar bear looks white, its skin is black, and its hair has no color at all. Its thick coat is really two layers of fur: a waterproof undercoat of short hair and a layer of guard hair 6 inches in length. Each hair is really a hollow tube that you can see right through. Some of the sunlight bounces

off the hair, making the bear appear white; but most of the sun's rays pass through the hollow hairs and are trapped by the bear's black skin. Underneath this fur coat, the polar bear has a layer of fat that can be 4 inches thick. The polar bear can survive even when the outside temperature drops to -70 degrees F because this fat and layers of fur act as insulators, trapping its body heat.

Research Basis

Tomlinson, C.A. (1999) *The Differentiated Classroom, Responding to the Needs of All Learners* pp7-8.

Differentiated classrooms feel right to students who learn in different ways and at different rates and who bring to school different talents and interests. More significantly, such classrooms work better for a full range of students than do one-size-fits-all settings. Teachers in differentiated classrooms are more in touch with their students and approach teaching more as an art than as a mechanical exercise.

Kesidou, S. & Roseman, J. E., (2002), *How Well Do Middle School Science Programs Measure Up?* Findings from Project 2061's Curriculum Review.

Programs rarely provided students with a sense of purpose for the units of study. This program took account of student's beliefs that interfere with learning. It modeled the use of scientific knowledge so that students could apply what they learned in everyday situations.

Floden, R. A., Buchmann, M., and J. Schwille, J., (1987). "Breaking with Everyday Experiences" Teachers College Record 88, p. 263.

Representations of the subject need to take into account what learners are already likely to know and understand about the subject matter as well as the experiences and knowledge they bring with them from their environment.

Invitation to Learn

Pass the Penny

Heat is the flow of energy from hotter to cooler objects. Temperature is a measure of how much heat energy an object has.

Prior to this activity, mark a penny with a small, flat dot of fingernail polish. Provide each group of 4 or 5 students with a small cloth bag containing 5 pennies. Have a member of the group remove the marked penny and hold it for approximately 10 seconds in their closed fist. Quickly pass the penny on to the next group member, allowing them to hold the penny for about 10 seconds. Continue this process until the penny has gone around the group once or twice. (You may notice that the penny has become warm). Replace this

penny quickly with the others in the bag and shake them up. Ask a volunteer to reach into the bag and pull out the marked penny. How could they recognize which penny to choose? Why did this penny feel different than the others? What was the penny's heat source? What causes the temperature change of the penny? You might also try this activity by allowing the marked penny to lie in direct sunlight (or under a heat lamp) for 30 seconds, and repeat the activity. Were the results similar?

- As a differentiated variation, students could choose the objects put into the bag for this activity according to their understanding of materials as heat conductors. They could also vary the number of objects used.

Instructional Procedures

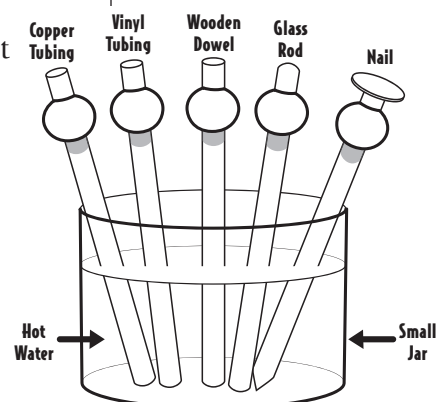
Race Some Beads

This activity will demonstrate how well some materials conduct heat.

- Cut the wooden dowel, copper tubing, and vinyl tubing to lengths of 4 inches.
- Attach one bead on the end of the glass rod, nail, and the 3 types of tubing using a small dab of butter. The beads should be attached using similar amounts of butter and the same distance from the end of each rod.
- Stand each rod up in a small glass jar so the bead on each rod is extending out of the container.
- Each rod will act as a conductor of heat. Predict the order of rod materials as heat conductors on your *Race Some Beads* recording sheet.
- Pour hot water in the glass jar and begin a timer.
- Heat will move from the water, into each rod, and melt the butter. The bead that falls first was attached to the best heat conductor.
- Record the amount of time it takes for each bead to fall.
- Compare the activity results to your prediction.
- Complete the *Race Some Beads* recording sheet showing the results of your learning and attach it into your journal.

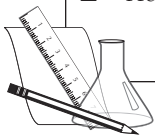
Materials

- ☐ Race Some Beads
- ☐ Glass jars
- ☐ Plastic beads
- ☐ Nail
- ☐ Wooden dowel
- ☐ Vinyl Tubing
- ☐ Copper Tubing
- ☐ Glass Rod
- ☐ Butter
- ☐ Plastic Knife
- ☐ Plate
- ☐ Timer
- ☐ Plastic Beaker
- ☐ Hot water



Materials

- ☐ Jars with lids
- ☐ *Bottling Heat*
- ☐ Aluminum foil
- ☐ Cork
- ☐ Scissors
- ☐ Tape
- ☐ Thermometers
- ☐ Timer
- ☐ Hot water



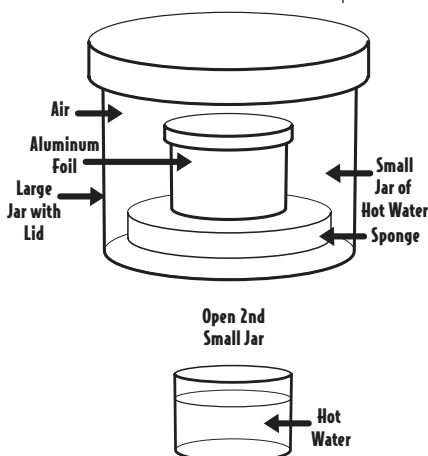
Bottling Heat

1. Wrap two layers of aluminum foil tightly around one of the small jars with the shiny side of the foil facing in.
2. Fasten the foil to the bottle with tape.
3. Place the cork in the bottom of the larger jar.
4. Fill both of the small jars with hot water of the same temperature.
5. Record the temperature of the water in these jars in your journal.
6. Place the lid on the small jar wrapped with foil. Do not put the lid on the other small jar.
7. Place the closed jar in the bottom of the larger jar, standing it on the cork.
8. Put the lid on the larger jar.
9. Leave the other small, open jar exposed to the air.
10. After 5 minutes, take the small jar out of the larger jar, open the lid, and record the water temperature.
11. Record the temperature of the water in the open jar.
12. Repeat steps 6-9. Wait 5 minutes and record the temperature of both jars.
13. Repeat steps 6-10 once again and take a final reading.
14. Draw and graph your results using the *Bottling Heat* worksheet. Attach it in your journal.
15. Compare the difference in the temperature of the two bottles and explain your results in your journal.

What happened to the temperature of the water in the open jar? Where did the heat go? What has insulated the water in the closed inner jar?

Heat does not pass easily through the insulated jar, the cork, and the air in the large jar. Water in the open jar loses heat more quickly. A Thermos flask keeps drinks hot or cold. It is made using two containers with a tight lid, like your heat store. The inner container has shiny sides and a double wall with a “vacuum” or empty space inside. It is so difficult for heat to leave or enter the flask that its contents stay hot, or remain cold, for a long time.

- You may wish to use this differentiated variation for this activity. When students have a good knowledge of how



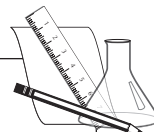
materials can be used as insulators, they could design their own insulating devices. Allow them to select containers and insulating materials they wish to use. You could allow them to choose different substances to test, rather than hot water.

Polar Padding

1. Have the students collect materials they feel could be used as good heat insulators.
2. Trace both sides of the polar bear on a piece of lightweight Pellon (9 in. X 11 in.) using the *Polar Padding Pattern*.
3. Fold the bear to form a pocket.
4. Sew 2 sides of the bear using large eyed quilting needles and yarn or string. Leave the mouth end of the bear unsewn for stuffing.
5. Students may insulate their bear choosing 3 layers of material.
6. Place a thermometer inside their bear. Allow a few minutes and take the temperature of their insulated bear and record it in their journal.
7. Pour hot water into a Ziplock bag and place this “body” inside the bear on top of the thermometer.
8. After a few minutes record the bear’s new temperature.
9. Place your bear in its cold environment. You could take it outside on a cold, wintery day, place it in a freezer, or place it between two large zip-lock bags containing ice.
10. Record the temperature of your bear every 5 minutes for 15 minutes.
11. Graph and journal the results of the activity. Compare your findings with bears insulated using different materials.

Materials

- ☐ Polar Padding
- ☐ Pellon interfacing
- ☐ Various Insulating Material
- ☐ Quilting needles
- ☐ Yarn
- ☐ Thermometers
- ☐ Ziplock bags
- ☐ Ice
- ☐ Hot water



Assessment Suggestions

- Check student temperature charts, drawings, and journals for student understanding.
- Students will share activity results orally with those in their group or give a presentation to the class.
- Use a rubric for scoring the *Bottling Heat* activity.
 - 4 correct, complete, detailed
 - 3 mostly correct & complete, fairly detailed
 - 2 partially correct & complete, lacks some detail

- 1 incorrect, incomplete, missing important detail
- 0 no attempt

Curriculum Extensions/Adaptations/ Integration

- This activity could be adapted for a small group with each member selecting an insulating material. They could collectively construct their body, each contributing their insulating layer. Their group findings could be recorded and compared with other group results.
- Select a variety of warm-blooded animals from various biomes: whale, walrus, lion, kangaroo mouse, wolf, etc. Identify how the insulating layers of these warm-blooded animals help to maintain a constant body temperature. Construct a body using insulating materials for one of these animals following the procedures above and record your findings.
- As a differentiated activity, replace the polar bear with a picture of a lizard or another cold-blooded animal. Fill the baggie for the body of this animal with water at room temperature. Place materials inside its body that will act as heat conductor. Place our lizard in the sun or under a heat lamp. Record the temperature every 5 minutes as it absorbs the sun's heat. Place your lizard in the shade and record the temperature changes showing how it retains body heat.
- After reading the book *The Magic School Bus in the Arctic* by Joanna Cole as a class, each student would research on a polar animal and how layers of their body act as insulators against freezing Arctic temperatures. Posters displaying their findings could be shared and assessed.
- Have the students construct a class quilt. What considerations should be made it choosing the materials for their quilt? How does the weight of the batting and the fabric affect the quilt's efficiency for retaining body heat?

Family Connections

- Have students visit a local sporting goods store to observe and compare the weight, efficiency, and cost of various sleeping bags. What materials were used as insulators and how are they constructed?

- Using the Thermos company website, research what materials are used in making Thermos bottles and coolers. How can you select the best product when comparing product use and its efficiency?
- Looking at labels, identify the materials used in students' winter clothes: coats, mittens, boots, etc. Compare them to the materials used in summer clothing. Determine which are made using natural fibers compared to man-made products.
- Compare the materials used as handles, lids, and cooking surfaces of pans in your kitchen. When are heat conducting materials used, and when is it important that the material serve as heat insulators.

Additional Resources

Books

Cold, Colder, Coldest, by Michael Dahl (Animal Extremes Series); Children Library Resources Item #GK923763

Experiments with Heat, by Salvatore Tocci (A True Books Series); ISBN 0-516-22510-3

The Magic School Bus in the Arctic, by Joanna Cole; ISBN 0-590-18724-4

Temperature, by Brenda Walpole (Measure Up With Science); ISBN 0-8368-1363-4

Temperature, by Navin Sullivan; ISBN 918-0-7614-2322-5

Polar Bears, by Ann O. Squire (A True Books Series); ISBN 0-516-25473-1

Polar Bears, by Julia Barnes (100 Facts About Predators); ISBN 0-8368-4038-0

Polar Bears, by Timothy Levi Biel (Zoobooks); ISBN 0-88682-414-1

Media

Heat, Bill Nye the Science Guy Series Three, (Disney Educational Productions) Library Video Company VHS DN2226, DVD DW0577

Heat, The Way Things Work Video Series, by David Magaulay (Schlessinger Media) Library Video Company VHS DK7849, DVD DV6014

Animal Adaptations, (Discovery Channel School Series) Teacher's Media Company VHS TBRR-354074

Web sites

Kids Saving Energy, <http://www.eere.energy.gov/kids/>

Science NetLinks, <http://www.sciencenetlinks.com>

The Sun: Man's Friend & Foe, <http://library.thinkquest.org/15215/>

Thermos Company, <http://thermos.com/technologies.aspx>

Coleman Company, <http://coleman.com>

Name _____ Date _____

Race Some Beads

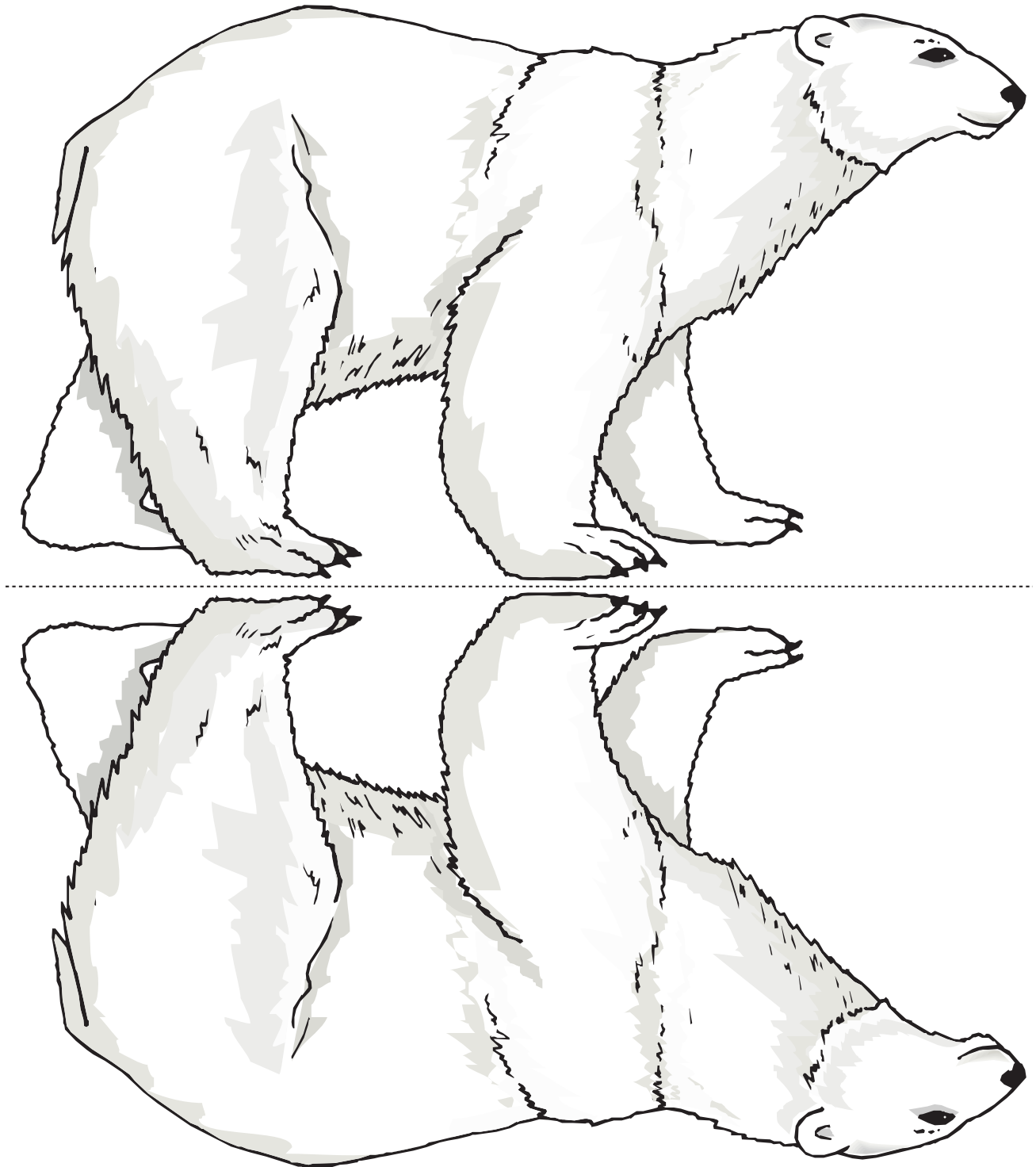
Items	Predict	Time	Result	

Name _____ Date _____

Bottling Heat

Temperature				
Times				Closed jar _____ Open jar _____

Polar Padding Pattern



Math IV-1&2

Activities

Measurement

To an Inch and Beyond!

Standard IV:

Students will select and use appropriate units and measurement tools to solve problems.

Objective 1:

Select and use appropriate tools and units to estimate and measure length, weight, capacity, time, and perimeter of two dimensional figures.

Intended Learning Outcomes:

1. Develop a positive learning attitude toward mathematics.
2. Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.

Content Connections:

Social Studies V1-1; Use grids, scales, and symbols.

*Math
Standard
IV*

*Objective
1*

Connections

Background Information

Students need to have a good understanding of why we have standard measurement. Non standard measurements change depending on what we use to measure. They need to be aware that all tools of measurement have two parts: a number and a unit. Whether we are measuring with standard units used in the United States, or metric units, all tools still have the two parts.

Students should be able to use their basic math knowledge to add three digit numbers together to determine the total distances measured.

Research Basis

Reynolds, A., Wheatley, G. H., (1997). Third Grade Students Engage in a Playground Measuring Activity. *Teaching Children Mathematics*. V4 n3 p166-70.

The authors discuss the benefits of expanding students hands on learning outside the classroom. Classroom settings(microspace) should be where the main teaching and practice take place but students need to transfer their knowledge and expand on it in a larger setting(macrospace). By doing this the authors found that students' unitizing activity in a variety of settings was associated with advances in mathematical thinking.

Akerson,V. L., Kelso, R., (2004). Math Connexions: Science and Engineering Applications in an Elementary Classroom. http://www.ed.psu.edu/CI/Journals/2000AETS/04kelso_akerson

The authors express how important it is for students to relate what they have learned in the classroom to life beyond the classroom

walls. When learning is extended across subject lines and into the real world, students' acquisition of knowledge is greatly enhanced.

Invitation to Learn

If you were an inchworm what would you be able to measure? Give each student a 1 inch rubber worm and invite them to find things in the room that are one inch, two inches, three inches or four. In their math journals have them make a tally chart showing how many items they found for each. Read *Inchworm And A Half* by Elinor J. Pinczes. Discuss how the inchworm had to get the help from his friends, focusing on the half inch and fourth inch, to complete the task of measuring everything in the garden.

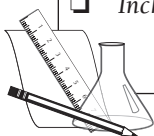
Instructional Procedures

What's in an Inch?

1. Pass out a ruler and magnifying glass. Using the overhead ruler, show the students where an inch is located and have them find it on their own ruler.
2. Explain that an inch is divided into many different parts. We are going to look at two of them. Flip over the next layer on the overhead ruler and place the whole and half fraction bars to demonstrate. Point out that when we find the middle of the inch, it is called a half inch.
3. Flipping over the next layer on the ruler and displaying the two parts of the fraction bars that make up a fourth, explain that each half is then divided in half and we call that one fourth of an inch and when it comes after the half inch it is call three fourths of an inch.
4. Check to see that all students have successfully located the one-fourth inch between 0-1/2" and three fourths of an inch between 1/2-1".
5. Pass out a 10-inch piece of yarn, an index card and scissors to each student. Tell them that we are going to be measuring our smile.
6. First they will measure their own smile to the closest 1/4" with their yarn and cut it. On their index card they will write "Name's Smile". Under their name they will write how big their smile is in inches. Make sure they leave enough room on the card to attach their individual string later.

Materials

- ☐ Standard Ruler
- ☐ Magnifying glass
- ☐ Measurement worms
- ☐ Index card
- ☐ Yarn
- ☐ Scissors
- ☐ Glue
- ☐ Yardstick
- ☐ Overhead ruler
- ☐ Overhead fraction bars
- ☐ Post-it note
- ☐ Measurement Cards
- ☐ *Inchworm And A Half*



7. Next, students will use the other side of their ruler and measure their yarn to see how many centimeters it is. Record it on the card under the measurement for inches.
8. Group the students in four or five and instruct them to combine their strings, end to end, and measure how long their group smile is. One student per group will write their total on the post-it note.
9. Students will now glue their individual strings to their index card with glue.
10. Make a frequency table on the white board and have one student from each group record their total on the table.
11. After adding all the totals together, write the grand total on the board telling the students that we will now make a class smile. Discuss ways that we could measure this large number instead of inch by inch.
12. Measure the length in yarn of the class smile using a ruler or a yardstick. On a poster board write “Our Class is all SMILES” and record the total smile in yards, feet and inches. Display the class string along with student’s individual smile cards in the hallway.
13. Students create a pocket in their math journal to save their smile card in, once the display is removed.

What’s Beyond and Inch?

1. Remind students that we used other tools to measure our class smile instead of measuring inch by inch. List the tools on the board and explain that we are now going to expand our knowledge of measuring to measuring the width of our classroom.
2. Group students in four or five. Explain that using inches would be too difficult and that we can measure by feet or by yards. Ask them, when you say “feet” what does it make them think of?(their own feet)
3. Assign each group to an area in the room to work. Have them take turns putting one foot in front of the other until they get to the other side of the room. Give each group a scratch paper. Have one student write everyone’s name in the group on the scratch paper along with their estimate of the classroom width.
4. Record all estimates on the whiteboard. Discuss the difference between the totals and why they are so different. Explain

Materials

- ☐ Standard Ruler
- ☐ Foot Ruler
- ☐ Yard stick
- ☐ Pencil
- ☐ Paper Airplane
- ☐ Scratch paper
- ☐ Painter’s Tape
- ☐ Pencil
- ☐ Eventful Activity Cards



that this is a nonstandard unit of measurement and that not all students have the same size foot.

5. Pass out 2 foot rulers to each group. Have them place the foot on the floor next to their own foot. Which is bigger? (the foot ruler) “Imagine how long your foot would be if it was an official foot long.”
6. Go over the attributes of the foot. Show the students how a foot is similar to an inch where it has a one-fourth measurement, a half measurement, and a three-quarters measurement.
7. Using their foot rulers, placing them end to end, students will again measure the width of the classroom. Discuss how many actual feet wide the classroom is.
8. Record how many feet wide the classroom is on the whiteboard and compare it to the estimates.
9. Discuss how this activity could have been easier if a yardstick had been used. How many yards wide is the classroom?
10. Once students have complete their classroom measurements, take them to an area where a long jump, ball toss, and airplane launch can take place.(gym, commons area, outside) Students will need their math journal and a pencil.
11. Assign students to three groups. The three stations have a starting line, instruction card, and measurement tools.
12. As students complete their designated task, he/she will record results in math journals under a title Eventful Activities. Record the station visited and the distance measured for each activity.
13. At the signal of the teacher, students rotate to the next area until all tasks have been completed.

Assessment Suggestions

- As students turn in their index cards to be displayed, check to see that they have labeled and recorded their information correctly.
- Journal Entry-Students will glue measurement cards (one inch, one-half inch, and one-fourth inch) in their journals. Under each card have students write a definition for each and cut a piece of yarn to match each measurement.
- Journal Entry- Have students create a reference chart. How many inches in a foot. How many feet in a yard.

Curriculum Extensions/Adaptations/Integration

- For measuring small objects, have students write their full name on graph paper and measure its length. Students then compare the length of their name to other students in the class.
- As an extension, challenge students to convert their measurements to another form, such as inches to feet.
- Explain that we can also use our body to measure objects. Our index finger from first knuckle to second knuckle is one inch, etc.
- If Force and Motion lesson has been taught, use airplanes that were made for the airplane launch in the Eventful Activities.

Family Connections

- Challenge students to do the same smile measurement activity with their family and bring the results the following day to compare with the rest of the class.

Additional Resources

Books

Inchworm And A Half, by Elinor J. Pinczes; ISBN 039582849X

How Big Is A Foot?, by Rolf Myller; ISBN 044040495

How Big Is It?, by Ben Hillman; ISBN 0439918936

Twelve Snails to One Lizard, by Susan Hightower; ISBN 0689804520

Millions To Measure, by David M. Schwartz; ISBN 043963389

Hershey's Milk Chocolate Weights and Measures, by Jerry Pallotta; ISBN 0439388775

Snakes Long Longer Longest, by Jerry Pallotta and Van Wallach; ISBN 0439896258

How Long or How Wide?, by Brian P. Cleary; ISBN 9780822566946

Web sites

<http://www.brainpopjr.com/math>

<http://classroom.jc-schools.net/math-unit/anprob.html>

<http://www.edhelper.com>

Measurement Cards

One Inch

Half Inch

One Fourth Inch

Three Fourths Inch

Eventful Activity Cards

<p>Long Jump</p> <p>Materials: ruler or yard stick</p> <ol style="list-style-type: none"> 1. Stand on starting line. 2. Jump forward 3. Have a partner measure the length of your jump. 4. Write the length in your journal. 	<p>Snow Ball Toss</p> <p>Materials: scratch paper, ruler, or yard stick</p> <ol style="list-style-type: none"> 1. On a piece of scratch paper, write something new you learned about measurement. Crumple paper into a ball. 2. Standing on starting line, toss the paper ball. 3. Measure the distance the ball traveled. 4. Write the distance in your journal. <p>Leave balls in position thrown until group member have had a turn. When teacher signals to change stations run and grab a paper ball and read what someone else has learned about measurement.</p>	<p>Airplane Launch</p> <p>Materials: paper airplane, ruler or yard stick.</p> <ol style="list-style-type: none"> 1. Stand on starting line. 2. Launch airplane. 3. Measure the distance the airplane flew. 4. Write your distance in your journal.
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WOW! How Time Flies!

Math Standard IV

Objective 2

Connections

Standard IV:

Students will select and use appropriate units and measurement tools to solve problems.

Objective 2:

Solving problems involving measurements..

Intended Learning Outcomes:

5. Connect mathematical ideas within mathematics, to other disciplines, and to everyday experiences.
6. Represent mathematical ideas in a variety of ways.

Content Connections:

Language Arts 1-1; Develop language through listening and speaking.
Language Arts VIII-6; Write in different forms and genres.

Background Information

Students need to have a basic understanding of how a clock works and be able to display time to the hour and half hour. They should also be able to represent a time on an analog clock and duplicate the same time in digital form. Students should know that 12:00 a.m. is midnight and 12:00p.m is midday and the times between them are a.m. and p.m.

Students should be familiar with story problems and be able to understand what the problem is asking by locating the facts and determining what operation is needed. They should be able to represent their thinking by expressing their answers on paper.

Research Basis

Heddens, J. W., Improving Mathematics Teaching by Using Manipulatives. Retrieved December 5, 2007, from <http://www.fed.cuhk.edu.hk/~fllee/mathfor/edumath/9706/13hedden.html>

What are manipulative materials? Manipulative materials are concrete models that involve math and can be touched and moved around by the students. They must be materials that relate to the students' real world. They should be selected for the appropriate concept being developed and on the appropriate level for the students.

Battle, T. S., (2007) Infusing Math Manipulatives: The Key to an Increase in Academic Achievement in the Mathematics Classroom. (ERIC identifier: ED498579). Retrieved January 8,2008, from http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/33/c0/97.pdf

Due to the lack of interest and understanding of concepts, students struggle in mathematics. Research shows that students' achievement increases when manipulatives are incorporated in a lesson. When

students are actively learning using manipulative materials they are able to apply what they learn to their own lives, thus forming a link between concrete and abstract learning.

Invitation to Learn

Using math journals have students cut a vertical and horizontal line in the middle of their paper. They will put a thin line of glue down the right hand side, gluing it to the page underneath. Fold back each corner in the center of the page to create a small triangle. Underneath the triangle place a clock that displays all numbers. Place clock so that the six and twelve are lined up under the vertical line and the three and nine line up under the horizontal line. Use a brad to fasten the hands on the clock. Explain to students that a clock is divided up into four parts just like an inch. Have them color each quarter of the clock a different color. Label the top right fold: quarter after = 15 minutes, lower right fold: two quarters = 30 minutes, lower left fold: three quarters = 45 minutes, and top left fold: four quarters = 1 hour.

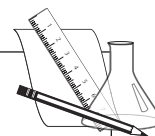
Instructional Procedures

Using a large Judy clock, demonstrate how the minute hand moves around the clock and as it makes a complete circle the hour hand moves gradually to the next whole number. Explain to students that we are going to be learning how much time passes from a starting time to an ending time. We call this elapsed time.

1. Pass out elapsed time rulers. Have students color the left side from 12:00 a.m. to 12:00 p.m. red and the right side from 12:00 p.m. to 12:00 a.m. blue. Explain how the red side is a.m. and the blue side indicates p.m. Have students cut out their ruler and glue it together with the numbers facing out and the 12:00 a.m. marks overlapping. Explain how we can count in the circle to figure elapsed time.
2. On the overhead, use a marker to draw a t-chart. Demonstrate how we can use a t-chart to figure elapsed time. Jamie put dinner in the oven at 5:15. It cooked for 2 hours. What time was the dinner ready to eat? At the top on the left side write the start time- 5:15. On the top at the other side write hour. In between the two draw an arrow pointing up to show that we are counting up. Next, make several horizontal lines going down the t-chart. Under hour write 1, 2. On the other side, under 5:15, count up the time by hours until it is on the same line as

Materials

- ☐ Math Journal
- ☐ Scissors
- ☐ Glue
- ☐ Crayons
- ☐ Judy Clocks
- ☐ Overhead projector
- ☐ Brad
- ☐ Analog Clock
- ☐ Elapsed Time Ruler
- ☐ Time Problem Cards
- ☐ Time Problems- Work It Out
- ☐ Baseball Time Game
- ☐ Baseball Handout



the 2. The left side should say 6:15, 7:15. The answer is 7:15. Have the students circle it.

Demonstrate figuring that an activity starts at 4:30 and ends at 7:30 we can use our t-chart to see how long the activity lasts. Draw a t-chart. At the top left side write the start time-4:30. On the top right side write hour. In between the two draw an arrow pointing up to show that we are counting up. Make several horizontal lines going down the t-chart. Under the start time count up by hours, writing them on the line, 5:30, 6:30, 7:30, until you get to the ending time. On the side with hours count up by ones to the line that matches on the left side with the ending time (1,2,3). Circle the 3. This is how much time has passed.

3. Using the 28 time problem cards, read a problem and have the students solve it by using their elapsed time ruler and a t-chart. Students may use the time problems- work it out worksheet to help determine what the question is asking.
4. Once students understand the concept of elapsed time, play “Baseball Time”. Baseball Time is created using green poster board. Use the board so that it is diamond shaped. Place home plate at the bottom and the three other plates in a diamond shape to home plate. You will need a baseball clipart for each student. Divide the class into two teams (A and B). Team A is “up” first. One at a time, give each student a time story problem. If the problem is answered correctly, the player scores a hit and all the players on base advance one base. If the answer is incorrect, the player scores an out. After one team has scored three outs, the next team is up. All students have a Judy clock and are figuring the problem at the same time as the student that is up to bat.

The team with the most points wins.

Assessment Suggestions

- As students are playing “Baseball Time” teacher will assess knowledge of concept by verbal responses to problems.
- Journal Entry- Have students draw two clocks in their journal. On the first clock, have them draw the hands to tell what time, to the closest quarter hour, they start school. On the second clock, they will draw hands to tell what time (to the closest quarter hour) they get out of school. Using a t-chart to determine how many hours they are in school.

Curriculum Extensions/Adaptations/Integration

- Advanced learners could figure time to the minute. On the right side of the t-chart they would write minute and count either by 1, 5 or 10 to get to the correct time on the left side.
- When students feel confident with figuring elapsed time, have them play “I have...Who has?”

Family Connections

- Encourage students to create problems at home and then figure elapsed time. Example; Dad leaves for work at 7:30 a.m. and returns home at 5:30 p.m. How many hours did Dad work?

Additional Resources

Books

How Do You Know What Time It Is, by Robert E. Wells; ISBN 0807579394

Math Curse, by Jon Scieszka and Lane Smith; ISBN 0670861944

Games

Race Around the Clock

I Have... Who Has... Mental Math Practice Cards- Elapsed Time

Web sites

http://www.harcourtschool.com/activity/elab2002/grade_3/018.html

<http://www.edu4kids.com/index.php?TB=20&page=13>

[http://www.shodor.org/interactivate/activities/ElapsedTime/?version=1.5.0_06&browser=MSIE
&vendor=Sun_Microsystems_Inc.](http://www.shodor.org/interactivate/activities/ElapsedTime/?version=1.5.0_06&browser=MSIE&vendor=Sun_Microsystems_Inc)

Time Problem Cards

Brenda ran track. She had a track meet today that would start at 11:00 a.m. and finish at 4:00 p.m. How long will her track meet last?	Colton and his friends loved to play video games. They all met at Robert's house and played for 2 hours and then went to the game store for 1 hour. Colton got home at 8:00 p.m. What time did he meet his friends at Roberts?
Kathy was going to be in the school play. It is 2:30 p.m. and rehearsals will begin in 3 hours, but Kathy still needs to learn her last part. How much time does Kathy have to learn her part?	Max and his family went to the zoo. They arrived at the zoo at 10:15 a.m. After visiting all the animals for 3 hours, his family had a picnic at the zoo park. They left the zoo at 2:15p.m. How long was their picnic?
Brianna loved to draw and had entered her pictures in an art contest. It is 8:00 p.m. and she must have her pictures to the show by 7:00 a.m. on the next day. How much time does Brianna have to get ready for the art show?	Steve is late for school. School starts at 8:45 a.m. and Steve arrived at 10:45 a.m. How late was Steve for school?
Amy's mom was having lunch with her friends today. It was 10:45 a.m. and Amy's mom asked her to help get things prepared for their lunch at 12:45p.m. How much time do they have to prepare for lunch?	Kent's family went to Disneyland. They left their house at 7:30 a.m. to catch their flight. They arrived in California at 11:30 a.m. and got to their motel at 12:30 p.m. How long did Kent and his family travel for?
Olivia and her best friend are going to a concert. The concert will start at 7:00 p.m. and will be over at 12:00 a.m. How long will the concert last?	Today is Jackson's big day. He is graduating from high school. He is so excited that he wakes up at 5:30 a.m. Graduation starts at 6:30 p.m. How much longer does Jackson have to wait?
Rose is starting her new job. She needs to be at work by 7:00 a.m. and will finish at 4:00 p.m. How long will Rose be at work?	Logan and Lincoln are Ute Football fans. It is 9:30 a.m. and Logan's dad is taking them to their first game. The game will start at 12:30 p.m. How much time do they have to get to the game on time?
The Jensen's family reunion is today. They left their house at 11:15 a.m. and have to travel for 4 hours. What time will they arrive at the reunion?	It was 3:00 p.m. and the Andersons needed to be to the movie in 1 hour. What time does the movie start?

Time Problem Cards

Jenna has piano lessons at 4:30 p.m. It is now 11:30 a.m. How long does Jenna have until her lessons?	Jim started work at 6:00 a.m. He took one hour for lunch and finished work at 3:00 p.m. How long did Jim work for?
Cyndi got a new puppy for her birthday. She took the puppy to show her friends. She left at 4:45 p.m. and returned home at 5:45 p.m. How long was Cyndi gone for?	Kevin's game starts at 6:30 p.m. He still has to do his homework before the game. It is now 3:30 p.m. How much time does Kevin have to finish his homework?
Sally went for a ride on her scooter. When she got home it was 7:00 p.m. She rode her scooter for two hours. What time did she leave her house?	Mark's cat was lost. Jason told Mark that he saw a cat an hour ago. It was now 12:15 p.m. What time did Jason see the cat?
The Smith family went for a hike. When they got in the car to leave it was 9:00 a.m. When they returned home it was 2:00 p.m. How long was their hike?	Juan was excited to see the new movie that his mom told him about. The movie was going to start in 7 hours at 6:00 p.m. What time is it now?
It is 8:15 a.m. and Shelly's Grandma King is going to visit them today. Grandma told Shelly that she would be there at 1:15 p.m. How much longer does Shelly have to wait to see her grandma?	Kenny and Tommy were waiting for the swimming pool to open. The pool hours are from 11:00 a.m. to 10:00 p.m. How long could Kenny and Tommy stay at the pool?
Gabby was so excited for her first day of school in third grade. She goes to bed at 8:30 p.m. and wakes up the next morning at 6:30 a.m. How long did Gabby sleep for?	Sonja's parents both work. His mom gets home from work at 4:00 p.m. and his dad gets home at 6:00 p.m. How much later does Sonja's dad work than his mom?
Carrie went to play at Patty's house at 2:00 p.m. They played for 2 hours and then went to Carrie's house and played for 1 more hour. What time did Patty leave to go home?	David fell off his bike and cut his knee. His mom took him to get stitches. When he got home, it was 2:30 p.m. They had been gone for 3 hours. What time did David and his mom leave their house to go and get stitches?

Time Problems—Work It Out!

Place Time problem here

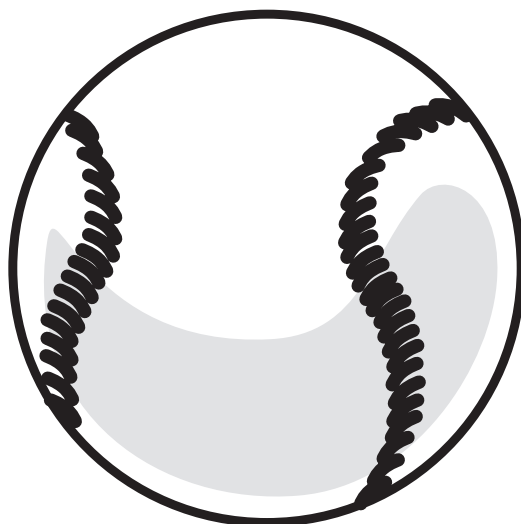
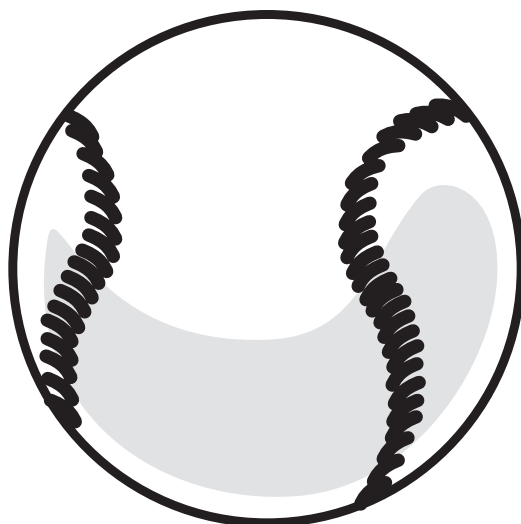
Explain to me what they are asking.

What are the facts? Are there any important words?

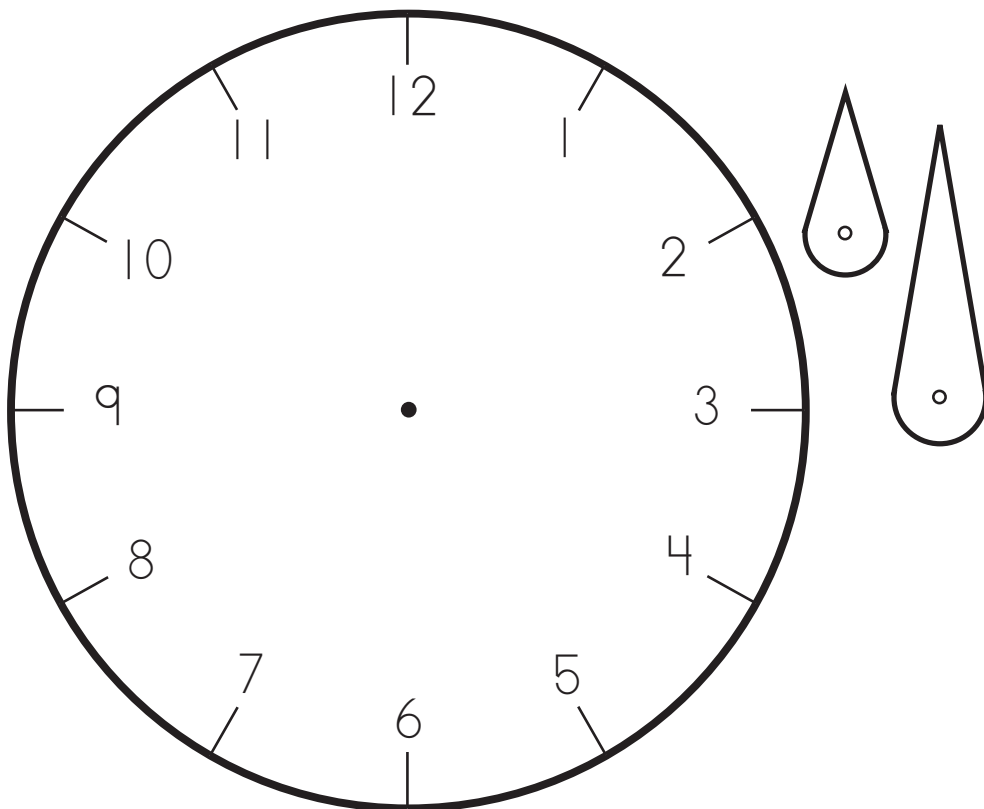
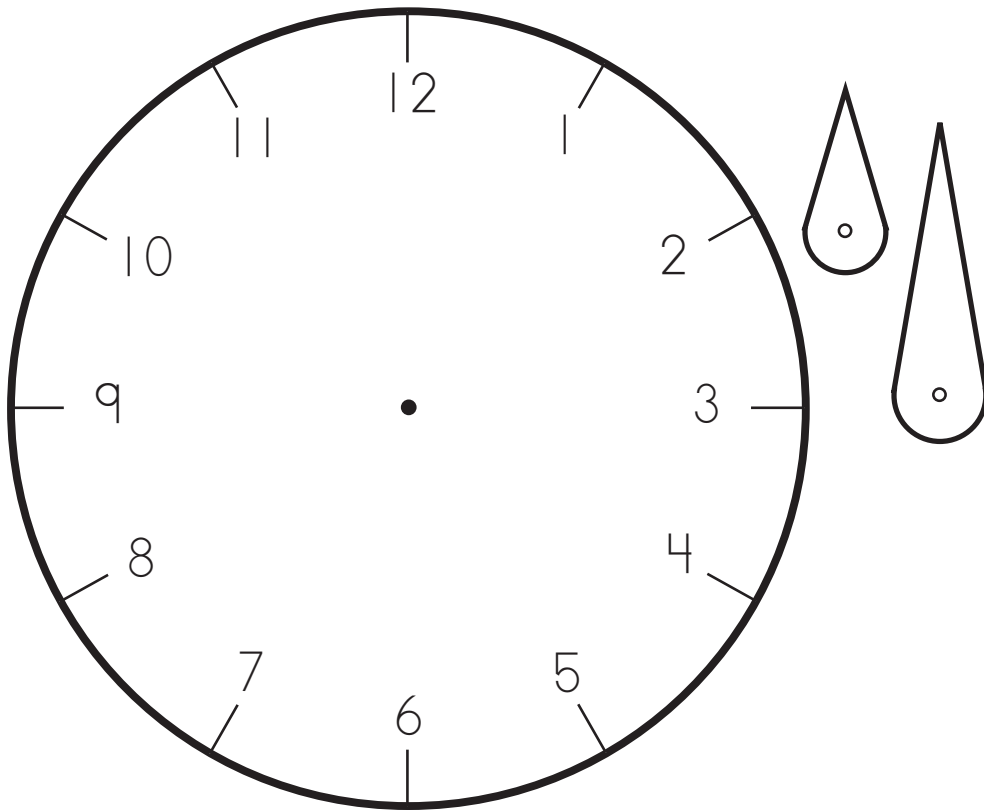
What is your plan? Show me.

Why do you feel your solution is correct?

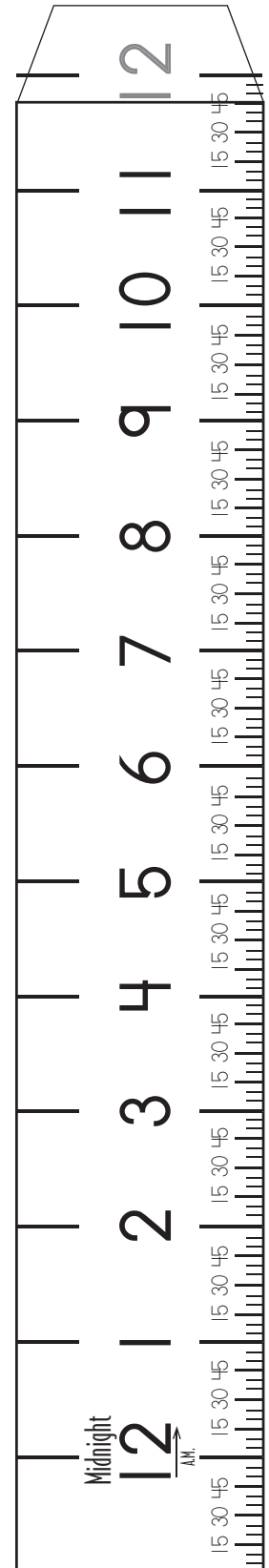
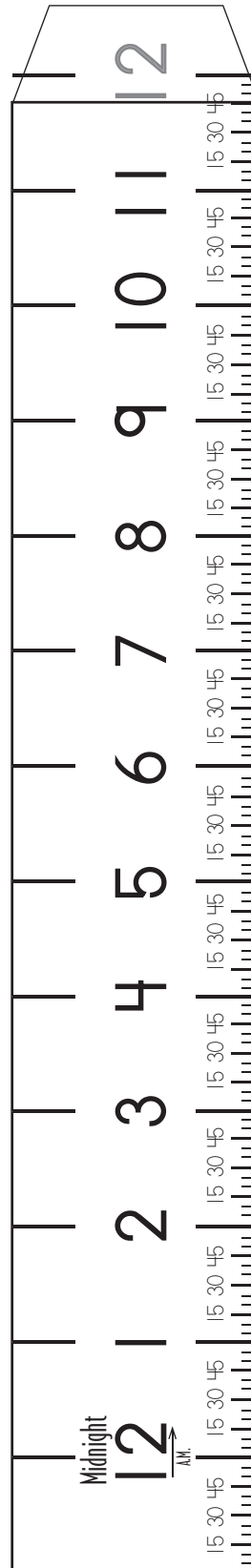
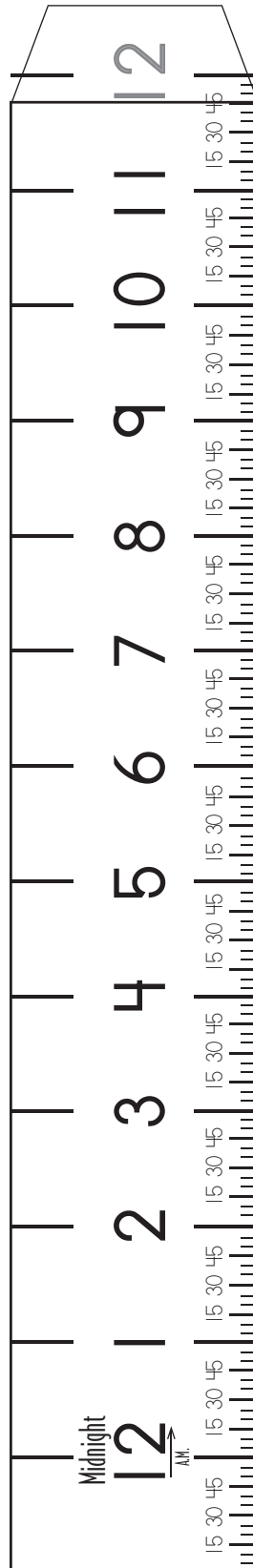
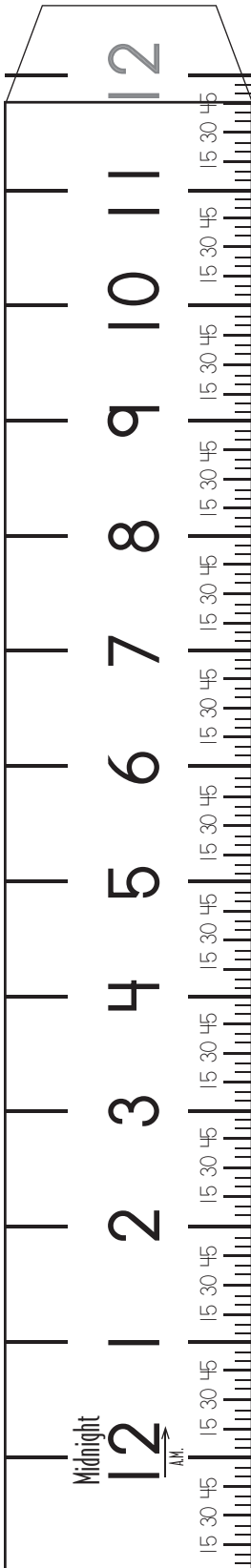
Baseball Handout



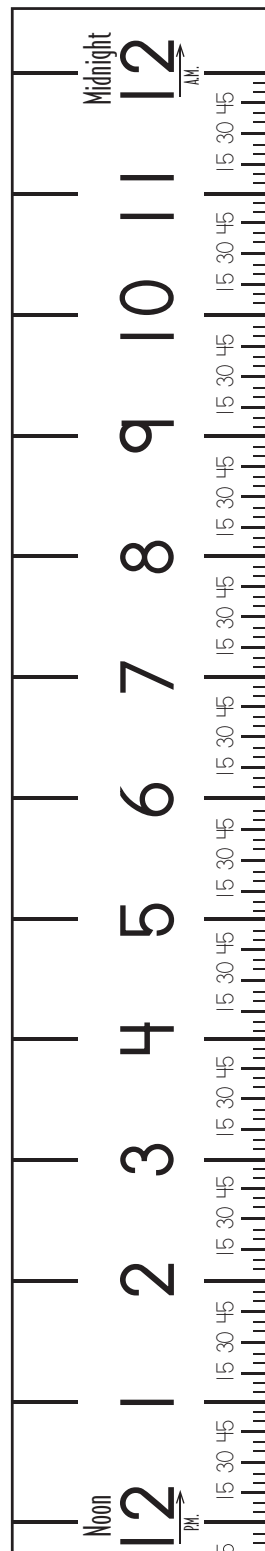
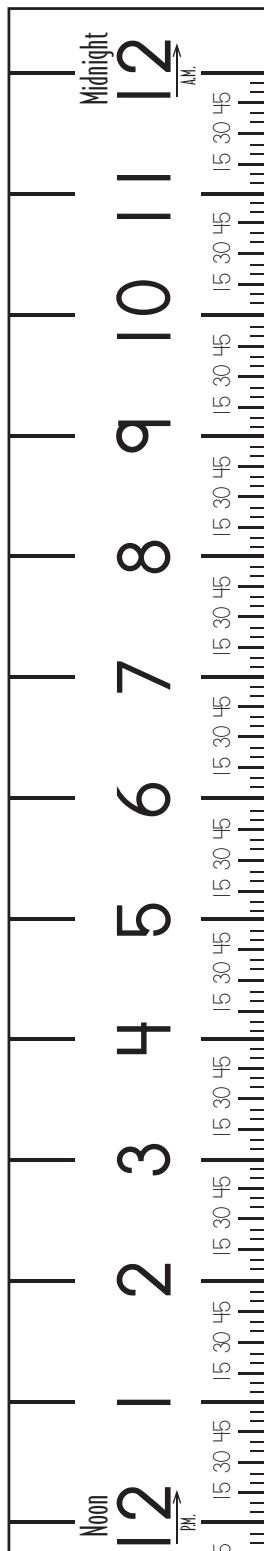
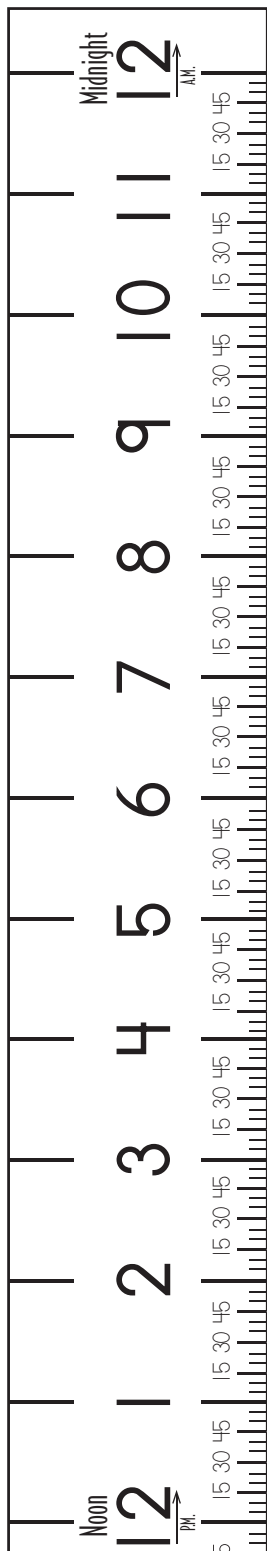
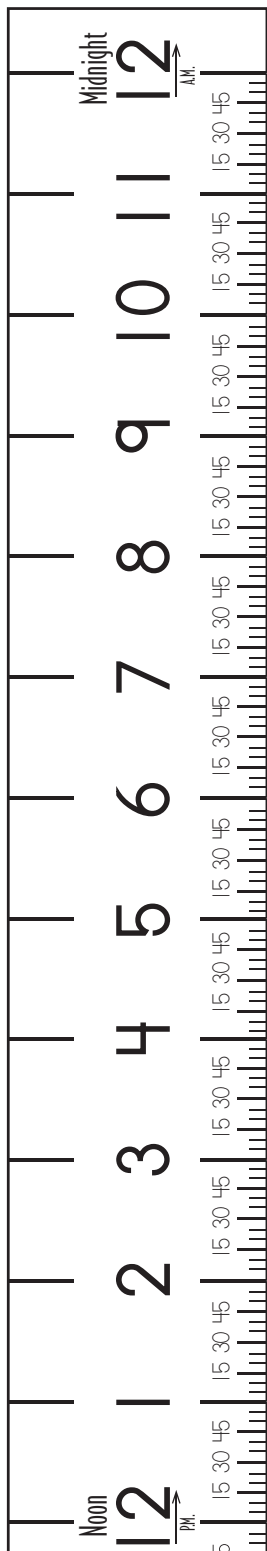
Wow! How Time Flies



Elapsed Time Ruler



Elapsed Time Ruler



Science I

Activities

M o o n

The Earth Is Flat

Standard I:

Students will understand that the shape of Earth and the moon are spherical and that Earth rotates on its axis to produce the appearance of the sun and the moon moving through the sky.

Objective 1:

Describe the appearance of Earth and the moon.

Intended Learning Outcomes:

1. Use Science Process and Thinking Skills
4. Communicate Effectively Using Science Language and Reasoning

Content Connections:

Math III-1; right angle, Math IV-1; elapsed time
Social Studies III-1; development of culture

Science Standard

I

Objective

1

Connections

Background Information

The fact that Earth is not flat is not obvious to children. It is a sphere that is 7,926.41 miles (12,756.32 kilometers) in diameter at the equator. One of the first ways that we suspected that Earth was round was because we could see its shadow on the moon during an eclipse.

It would be helpful for the teacher to practice with the pencil top to find the best length for the pencil. Longer pencils do not work as well. In my observations it seemed best to have a pencil about 2 inches long.

Research Basis

Furner, J. M., Yahya, N., and Duffy, M. L., (2005). 20 Ways to teach mathematics: Strategies to reach all students. *Intervention in school and clinic*, Volume 41, No. 1 (September 2005), Pages 15 -23.

Even though this article is written with different approaches to teaching mathematics, the hands-on activities, heterogeneous grouping, charts, auditory, visual and kinesthetic approaches work well in nearly any setting or grouping. It is just good teaching.

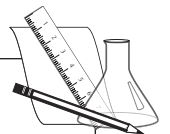
Invitation to Learn

The Flat Spinning Earth

Hand each student a washer and ask them to identify ways that the washer and Earth are the same. Color and cut out the outline drawings of Earth and glue them to one side of the washer. Using a single light source, like the sun coming through the window or a desk lamp and a playground ball or globe as a backdrop, invite them

Materials

- ☐ Polar Projection of Earth
- ☐ Fender washer
- ☐ Globe
- ☐ Journal



to notice the different possibilities of shapes made by the washer and record them in their journal. Now pass out a ping pong ball and ask them to identify and draw as many different shapes as can be made by the ball. Are there ways the washer makes a circular shadow? Is it possible to make the washer continuously appear to make a circular shadow? Instruct the students to make a Venn Diagram in their journal comparing Earth and the moon.

When we are outside, where and when can we see the shadow of the moon and Earth? Does this teach us about the shape of the moon and Earth? How? Take time to answer questions about eclipses.

Instructional Procedures

Materials

- ☐ Pencil
- ☐ Ping-pong ball
- ☐ Pizza box
- ☐ Aluminum foil
- ☐ Glue stick
- ☐ Crayons



The Flat Spinning Earth on an axis

1. “What do you do with a pencil that is too short to reasonably hold?” Ask the students to get the pencil that has been sharpened to within two inches of its life.
2. Insert the pencil into the hole in the washer far enough that friction will solidly hold it in place.
3. Write the word “axis” on a small piece of tape and attach it to the pencil nearer the eraser end.
4. Write the word “rotation” near the outer rim of the washer.
5. Practice spinning the “Earth top”. If it wobbles try to figure out why. What makes it spin longer? Does it help if the washer forms a right angle to the pencil all the way around?
6. Discuss the axis as it relates to the map of Earth on the washer with others at your table. Does Earth really have a pencil stuck through it? Does Earth spin like the washer?
7. Spin the ping-pong ball. Is there a place it seems to spin around? How is the ping-pong ball like Earth? How is the pencil in the washer like Earth?
8. Set the ping-pong ball aside for use in a later activity.
9. Make a pocket in your journal to store your disassembled Earth axis (pencil) and rotation model (washer with the map).
10. Demonstrate pop-up doors and a stand up. Share some of the pop-ups the students have made.
11. Invite the class to create some pop-ups in their journal.

Assessment Suggestions

- Prior to the lesson, as pre-assessment, spin a globe of Earth and ask “Is there some part of the globe where the spinning part is the smallest? Why do you think that happens?” (It is closest to the center of the spin, ‘rotation’). We call the center of the spin, axis. The part that goes around rotation.
- At random times during the year, after this activity, when the students are using their pencil for work, hold up a pencil and a washer and ask “When they are together the way we used them in Science what names did we give them?”
- Spin a ball during PE and then ask “What is the ball doing that is like Earth?” “Where is the axis?”

Curriculum Extensions/Adaptations/Integration

- The rotation of Earth on its axis causes our day and night. The orbit of Earth around the Sun measures our years. Did the ancient Native American people have a way to keep track of the elapsed time of years and seasons? Show Chaco Canyon Fajada Butte Sun Dagger. Discuss that they understood about the apparent motion of sun across the sky and used it to measure lapsed time. Show an analemma and discuss how it shows lapsed time. Answer questions and ask if it could be used to show more than days and months. Could we expand it to show time of day, make it a sundial? Show and discuss the San Francisco “sundial”. For your class it all begins with a small empty pizza box, some aluminum foil, paper, tape and a fine tipped marker or pen. Make a classroom solar calendar.
- A block of wood with a three eighths diameter hole three inches deep will help the challenged learner get the right angle between the axis (pencil) and the rotation (washer).
- Art: Earth on its axis model could be a colored pencil and then spun on a piece of black construction paper to add to other designs for fireworks display or to trace spiral type designs on other projects.

Family Connections

- Send a washer home with the student and a map to apply to the washer. With a note asking the parents to allow the student to review what they learned.
- Invite parents to help the student notice other places in life where there is an axis (like an axle on a wheel) and something rotates around it (the tire).

Additional Resources

Media

Sun Dagger video, by BullFrog Films(info@bullfrogfilms.com); ISBN (DVD) 1-59458-089-8

Pop-Up Books, by Interact (Highsmith, 1-800-359-0961, Highsmith.com); Item number - 95474

Web sites

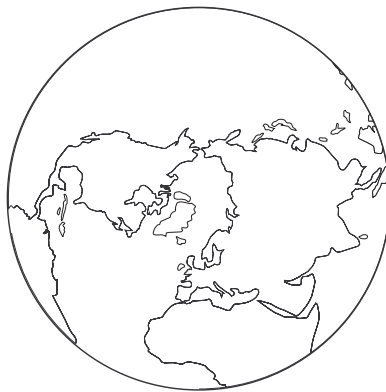
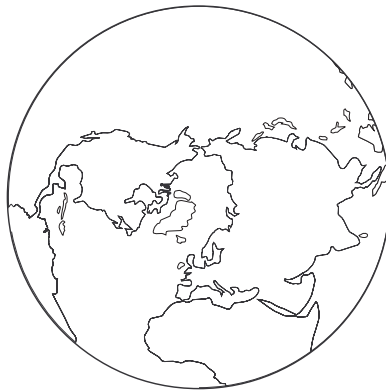
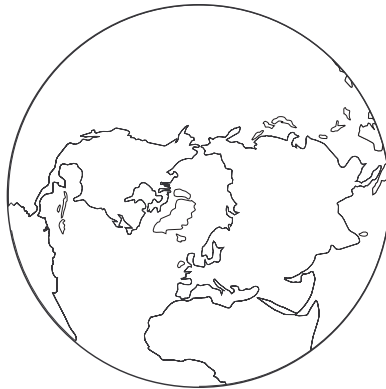
<http://www.traditionsofthesun.org/index.html>

<http://www.solsticeproject.org/science.html>

<http://www.tulane.edu/~danny/southwest.html> chaco-7.jpg and chaco-8.jpg

<http://epod.usra.edu/archive/images/analemma.jpg>

Polar Projection of the Earth



Science Standard I

Objective 2

Connections

A Moon With a View

Standard I:

Students will understand that the shape of Earth and the moon are spherical and that Earth rotates on its axis to produce the appearance of the sun and the moon moving through the sky.

Objective 2:

Describe the movement of Earth and the moon and the apparent movement of other bodies through the sky.

Intended Learning Outcomes:

1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests

Content Connections:

Math V-1; Gather and record data
Language Arts VIII-6; Writing in different forms

Background Information

When Earth and moon rotate, they turn to the left. This is easily remembered by asking the students to place their hand over the heart as when saying the “Pledge of Allegiance,” then push with that hand toward the shoulder closest to the hand, thus turning the individual toward the left.

The teacher should understand that the moon and Earth do not rotate on the same plane. This is why eclipses are much less frequent than the students might think.

Using the technology of space travel we have been able to see both Earth and the moon from space. In this activity we will help the students understand better what astronauts and astronomers see by using technology and models.

Remember to turn the flash off on cameras for this activity, otherwise you lose the shadows we are looking for.

Research Basis

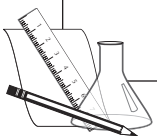
Waters, J. K., (2007-12-00). Social Studies Teachers’ Perspectives of Technology Integration. *T.H.E. Journal*, Volume 34 (Number 12), Pages 41-44

Menko Johnson, an instructional technologist at San Jose State University, believes that successful synchronizing of technology in the classroom puts the teaching before the gadgetry and will benefit both the teacher and the student.

Starkman, N., (2007-06-00). Sound Solutions. *T.H.E. Journal*, Volume 34 (Number 6), Page 22

Materials

- ☐ “Moon in My Room” lamp
- ☐ Paper cup
- ☐ Blank paper
- ☐ Crayons



Poor classroom acoustics have more to do with poor learning than one might suspect. A good sound system can do a great deal to help both the students and the teacher.

Invitation to Learn

Using a “Moon in My Room” lamp, ask the students to name the phases of the moon as it moves through the eight phases of lights on the lamp. This is a great attention getter. The students will be excited to learn more.

After demonstrating the “Moon in My Room” lamp, pass out paper cups and a piece of paper to make a paper version of their own moon phases.

Use the paper cup to make eight circles on a piece of blank paper. Then draw each of the phases on the different circles and cut them out. Fold the circles in half vertically. Glue the left half of the first phase to the right half of the next phase and so on until you have glued all the way around. One of the great features of this little gem is that it works as well upside down as right side up. They now have their own moon review kit.

Have the students make a pocket for their moon review kit in their science journal.

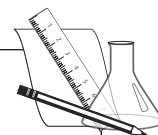
Instructional Procedures

Which View of the Moon?

1. Explain that we are going to build a model of Earth and the moon.
2. After dividing the class into small groups, ask each group to invent a constellation or choose a constellation they already know and draw it on a poster or large piece of paper.
3. Have the students retrieve their moon review kit from the invitation to learn activity above and keep it with them for this activity.
4. Move the desks away from the center of your room to make enough space in your classroom for a large circle of students.
5. Have half, (or one third if you have a large group), of the class stand in the middle of the room, in a circle facing outward. This is Earth. Make the circle as small as possible. Place a globe of Earth in the center of the circle on a table or tall cart, or hang it from the ceiling.

Materials

- ☐ Playground ball
- ☐ Camera
- ☐ Poster board
- ☐ Markers or crayons
- ☐ Moon review kit



6. Put eight chairs in a circle around and facing Earth. If possible these should be about ten feet from Earth. These chairs mark the path of the moon.
7. Ask one child to represent the moon, or the teacher may take this place being taller than the standing students on Earth so the sun can shine on it during all phases.
8. Invite the rest of the class to hold the “constellation” posters around the outside of the room.
9. Turn on a desk lamp or spotlight to be the sun. Turn off other lights and darken the room as much as possible. The sun and moon should not be in the same plane. Discuss what would happen if they were. Explain that we would have eclipses more regularly if this were the case.
10. Invite one student to use a camera to document what Earthlings see.
11. When everyone is in place, ask the students to take time to predict what they think they will see.
12. Have the “moon” start at the chair closest to the sun. Remember, the moon should face Earth. You might have the “moon” record what it sees of Earth with a digital camera each time it moves to a new chair, remembering that the moon would always look only toward Earth. If the teacher is serving as “moon”, a student may be asked to take the pictures.
13. The “Earthling” students should now move their circle to the left a full rotation taking time to find and compare what they see with the moon review kit what they are seeing of the moon after each rotation.
14. The “moon” should move one chair to the left of Earth in its orbit for each rotation of Earth. Repeat steps 12 and 13 a few times. It may not be necessary for Earth to rotate eight times before having the groups trade places.
15. Students who were “on Earth” should trade places with constellations and the moon.
16. After everyone has had the opportunity to see the view from both Earth and in space have the students return desks to their places and allow time to record what was seen. Encourage creativity in the kind of entry: pop-ups, drawings, written and so on.
17. Invite a few students to share and discuss with the class what they have recorded.

18. For review on another day, share the pictures taken with the camera and discuss and compare with journal entries.

Assessment Suggestions

- Ask the students to share with others at their table how the appearance of what we see from the moon, from Earth and from the stars is different and which one we might call “real”. How does this help them understand what we see on Earth?
- Use the “Moon in My Room” to show different phases for review during different times of the day and the year.

Curriculum Extensions/Adaptations/Integration

- Use a camera to take pictures from one of the constellations. What do you think an alien might see?
- Use the digital camera in video mode on Earth without stopping after each rotation of Earth to get a different feeling for the activity.
- Moon dance, invite everyone to hold the ping-pong ball from “The Earth is Flat” activity with only one source of light in the room at the side of the room, and ask them to turn around in a circle while watching the ball. Have them record what they saw in their science journal with pictures, words or pop-ups.
- Invite children with special needs to be the one to turn the sun on and off at the times designated by the teacher, or make sure they are part of one of the constellations. If they need to be active, have them be a comet passing through the solar system with a flashlight. Those who have trouble writing in a journal may use a tape recorder to record their ideas and then have a parent transcribe them (home connection).
- If you ask a Chinese person when their birthday is or a Muslim when the next Ramadan or Aid al Adha starts, what kind of calendar would they use to give you an answer? Discuss the fact that many cultures have used and continue to use a lunar calendar.
- Show the class how to make “pop-up” entries in their journal. Encourage some of the entries to be pop-ups. Allow for creativity and time to finish and share with the class using the document camera.

Family Connections

- Use a protractor with a straw attached along the flat side of the protractor, and a string tied through the center of the straw side with a weight at the end of the string as a measurement tool, sight along the straw and mark where the string is on the protractor. Keep a journal of the moon for one month or more. Each night at the same time of night, from the new moon to full moon, observe the moon using the protractor to note the angle in the sky for the location of the moon and which way the observer is facing, (a magnetic compass may be needed). On at least two nights go out two or three times to note that on any given night the moon seems to stay with the constellations, but on different nights it follows different constellations. After the full moon, observations will be more successful in the early morning. What path do you think the moon will follow? Does the moon track across the sky from east to west along the same path the sun does? What is the overall pattern of the moon's path across the sky in one month, 2 months, 6 months? Are those paths the same?

Additional Resources

Books

Eyewitness Books: Astronomy, by Kristen Lippincott; ISBN 0-75660656-X

Space: A Nonfiction Companion to Midnight on the Moon, by Mary Pope Osborne; ISBN 0-375-81356-x

Web sites

<http://www.adlerplanetarium.org/cyberspace/moon/culture.html#inca>

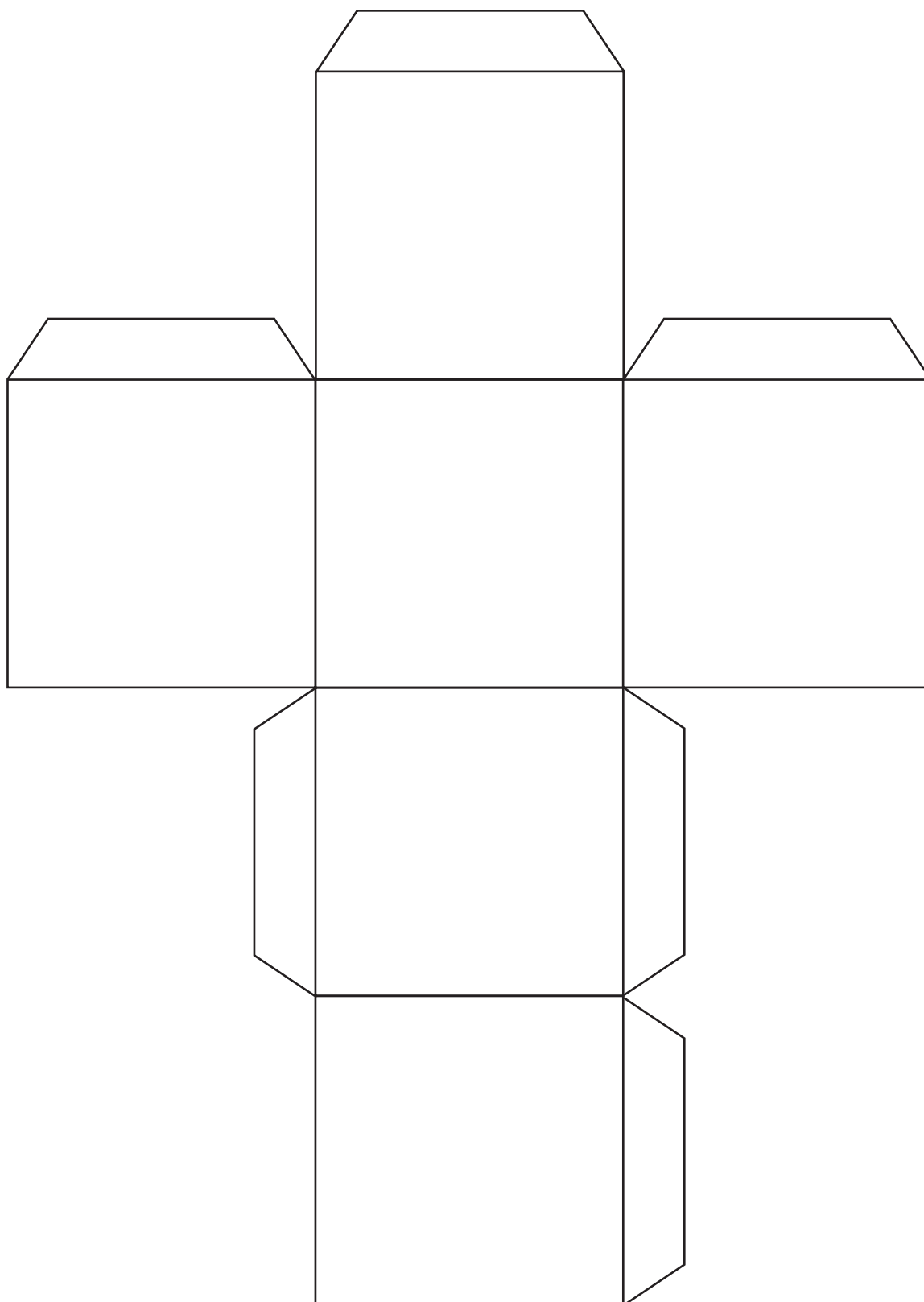
<http://starchild.gsfc.nasa.gov/docs/StarChild/StarChild.html>

http://www.clarkplanetarium.org/astronomy_clubs.php

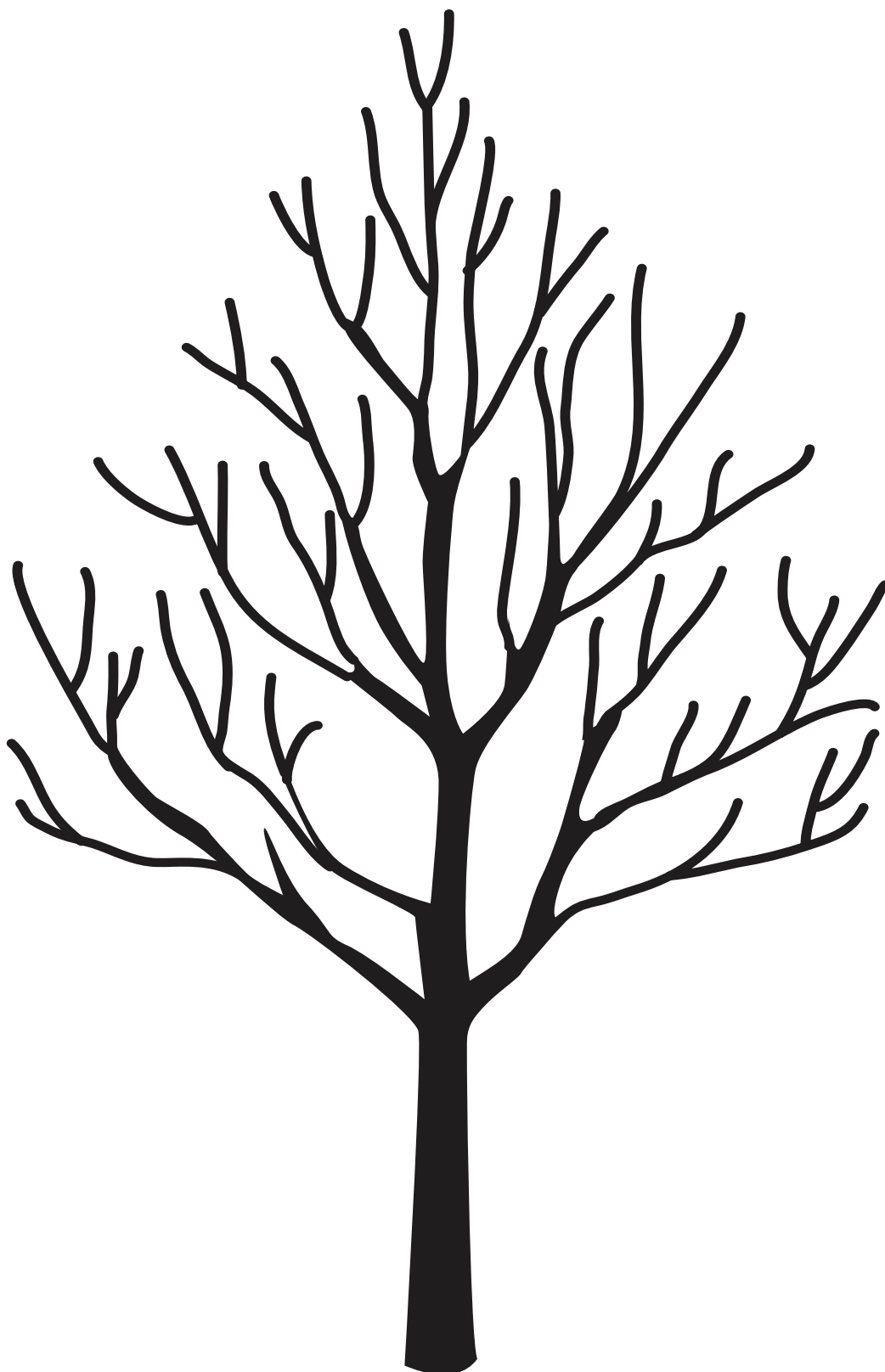
<http://www.space.com/php/multimedia/imagegallery>

Appendix

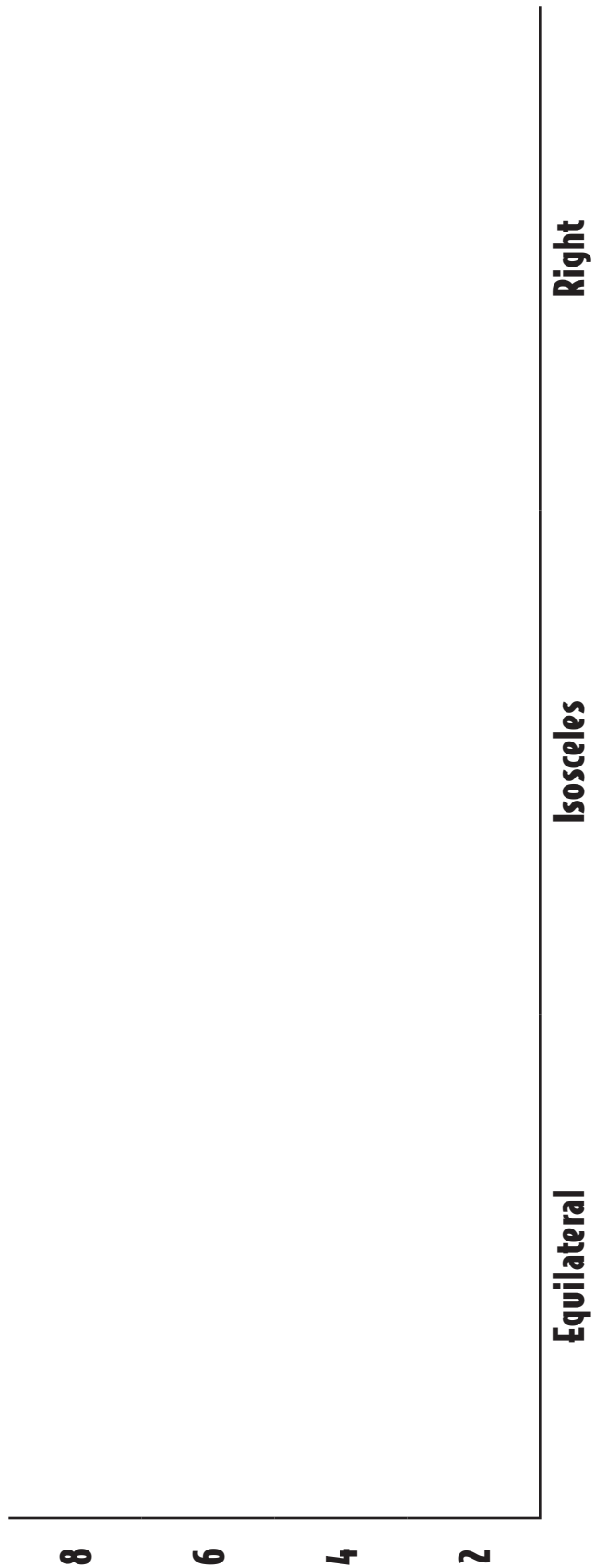
Cube



Growing Tree



Which Triangle Is It?



Red	Number of Sides
Blue	Number of Equal Sides
Green	Number of Right Angles
Yellow	Number of Greater Than Right Angles
Purple	Number of Less Than Right Angles

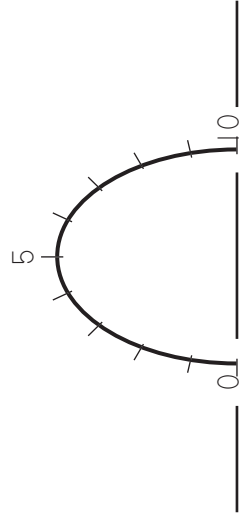
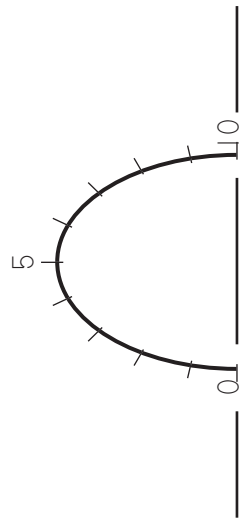
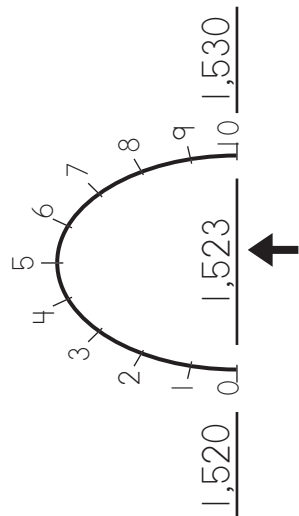
Dribble, Shoot, and Score



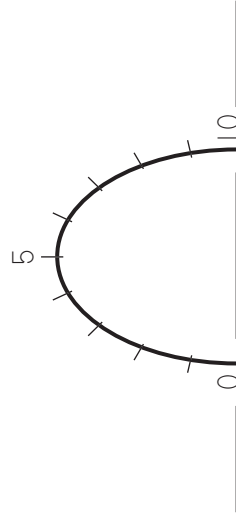
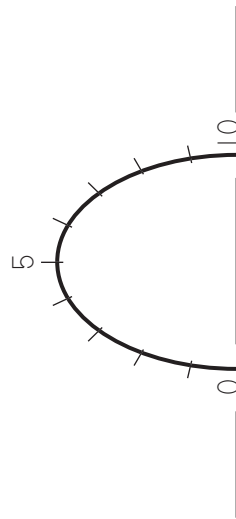
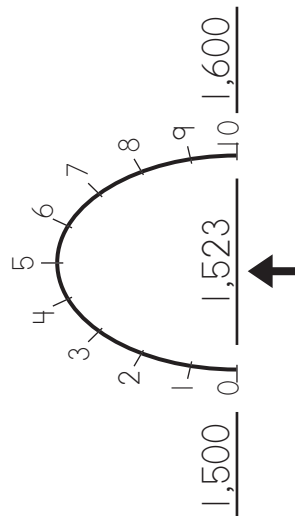
Name _____ Date _____

Rounding Mountains

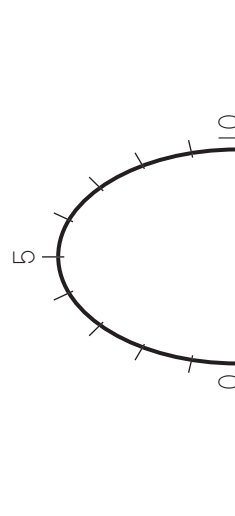
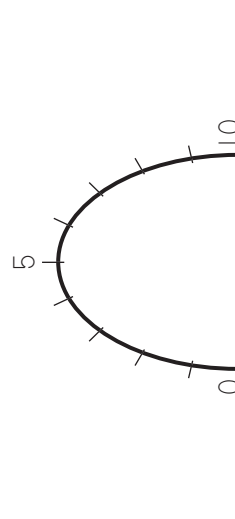
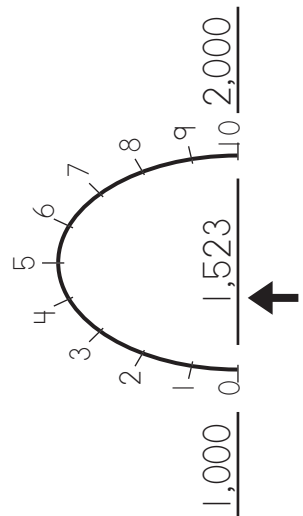
Round to the nearest 10



Round to the nearest 100



Round to the nearest 1000

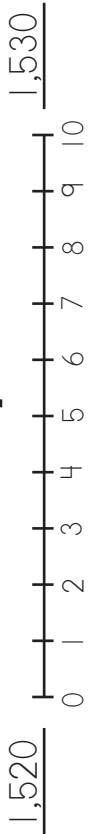


Name _____ Date _____

Number Lines

Round to the nearest 10

1,523



1,525



Round to the nearest 100

1,523



1,550



Round to the nearest 1000

1,523



1,500



Items	Predict	Time	Result

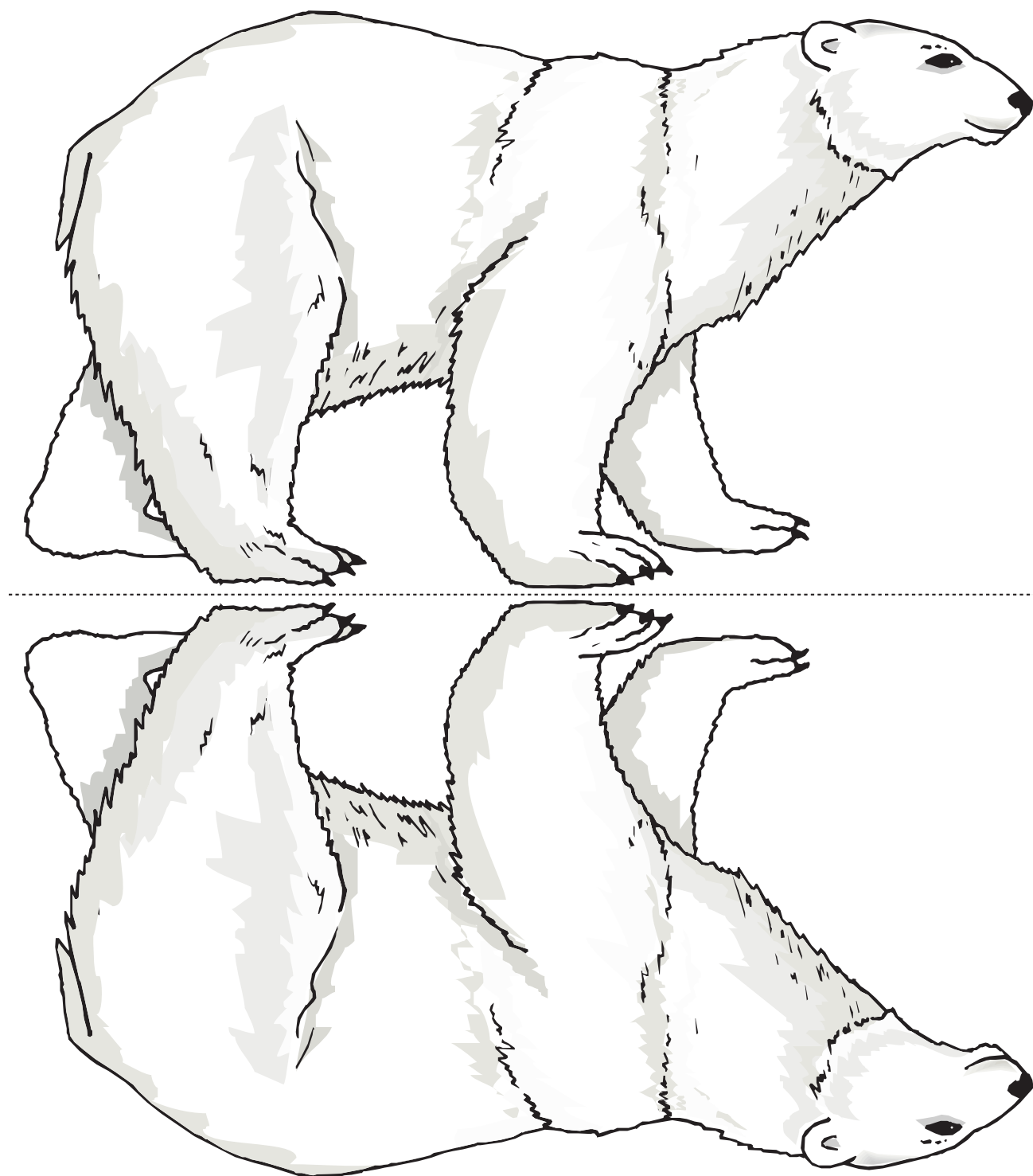
Name _____ Date _____

Temperature

Times

Closed jar _____
Open jar _____

Polar Padding Pattern



Measurement Cards

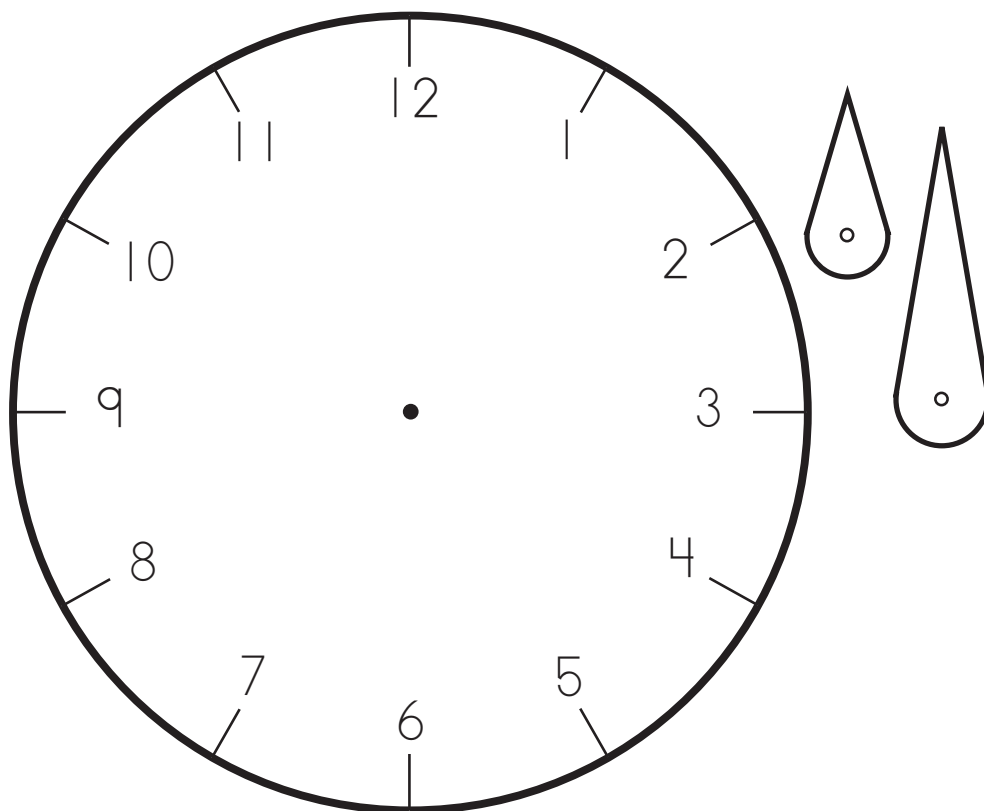
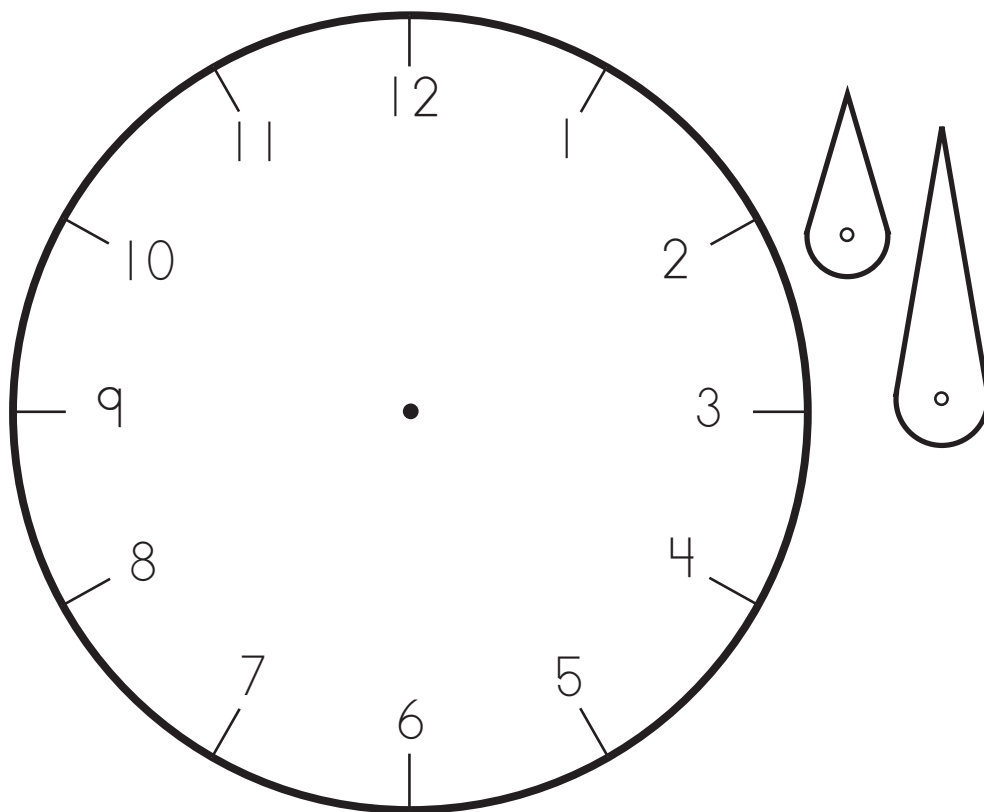
One Inch

Half Inch

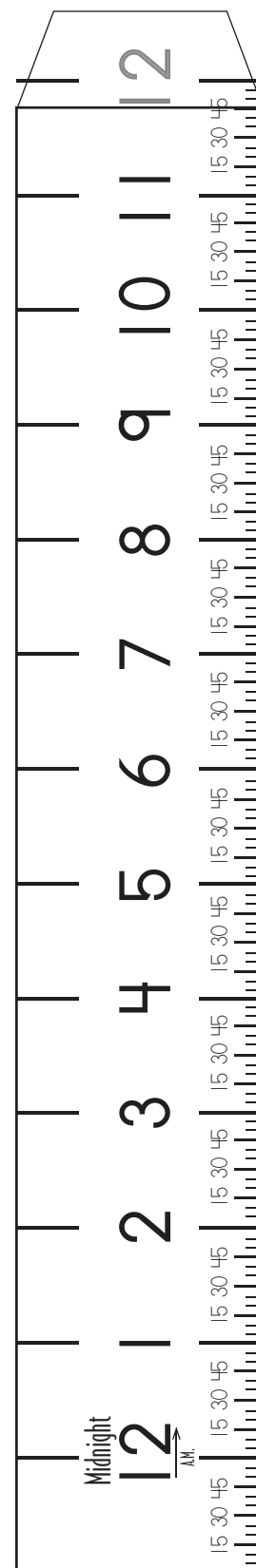
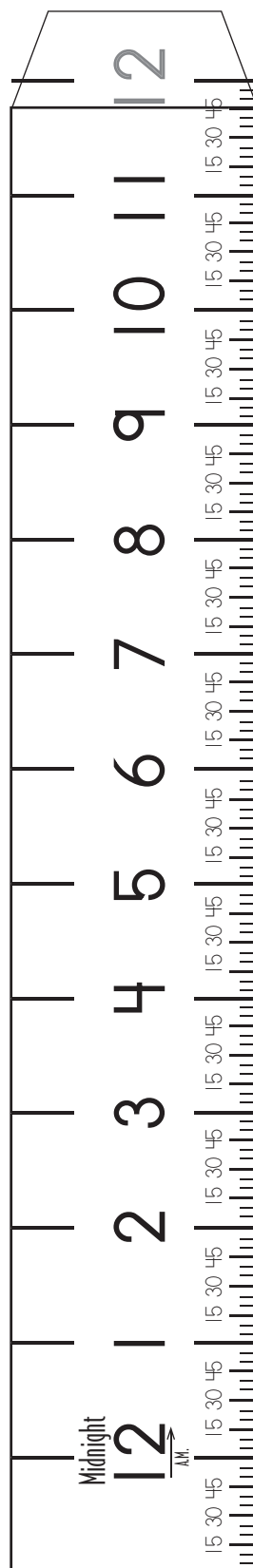
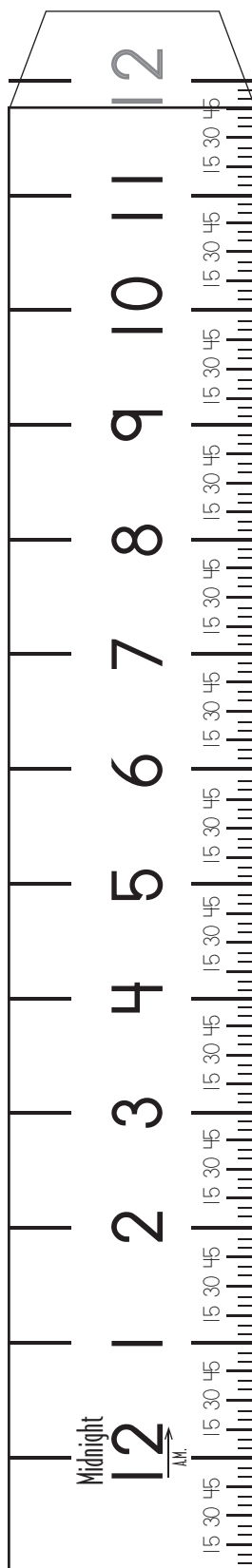
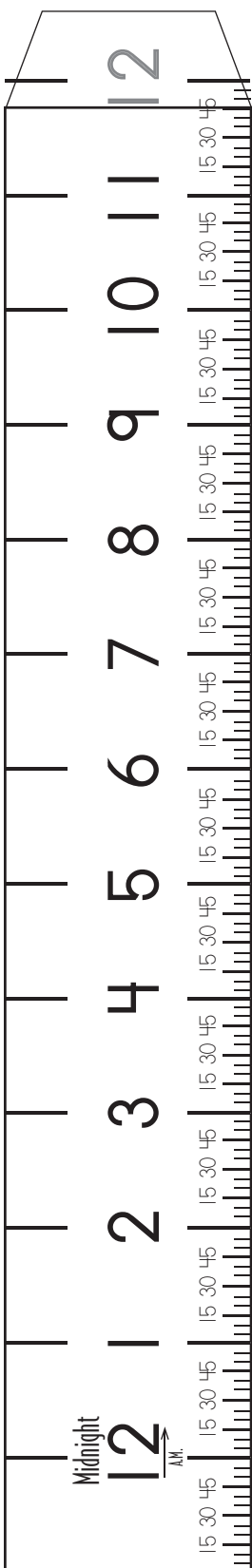
One Fourth Inch

Three Fourths Inch

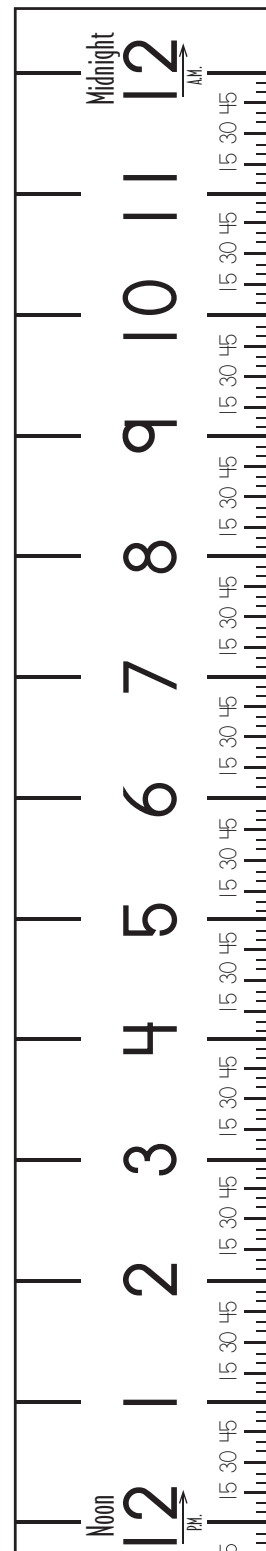
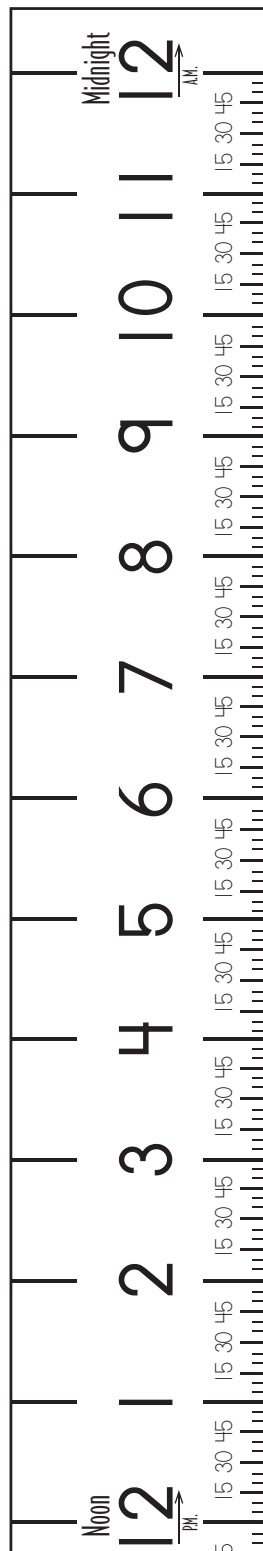
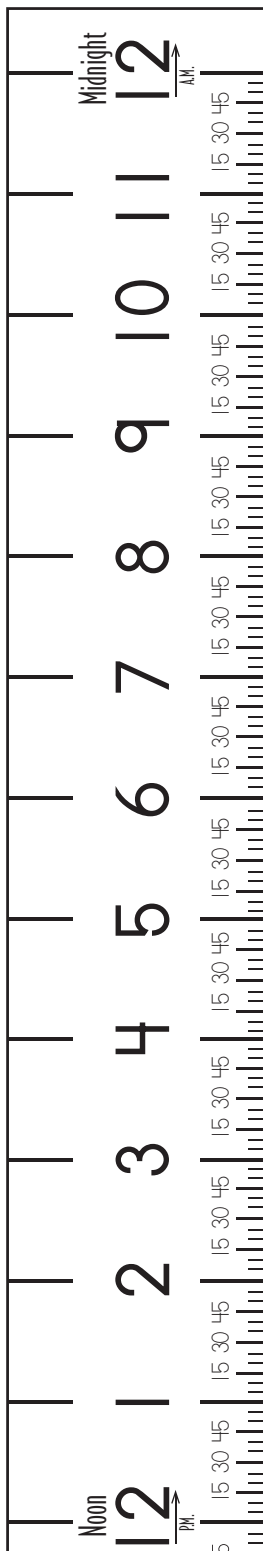
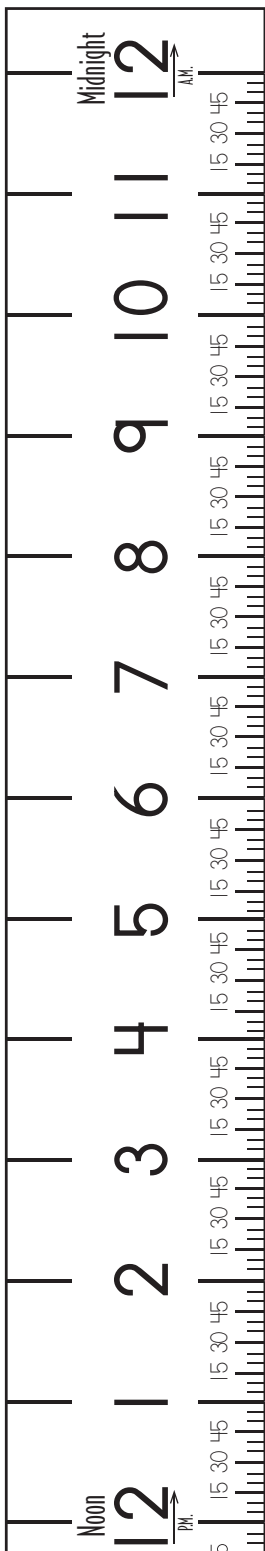
Wow! How Time Flies



Elapsed Time Ruler



Elapsed Time Ruler



Polar Projection of the Earth

